RWE

Clachaig Glen Wind Farm

Environmental Impact Assessment Report

Volume 3

Technical Appendices

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Appendix 1.1: Technical Competence of Project Team

Appendix 1.1 Technical Competence of Project Team

1.1.1 Key members of the project team for the Proposed Development are listed through **Error! Reference source not found.**. Project members are AECOM staff unless otherwise stated.

Table 1 Evidence of Technical Competence

Topic	Title	Description	Qualification
Project Director	Technical Director	More than 20 years' professional experience delivering Environmental Impact Assessments (EIAs) and environmental management plans for the energy sector. Has delivered over 20 wind farm projects in the UK, several of which are EIA development and others involving the discharge of planning conditions. His work has included leading EIAs for Section 36 Applications, managing the EIA for the UK's first major repowering project, carrying out construction audits of wind farms, and managing the delivery of planning conditions associated with several projects. He is an accredited AECOM Project Manager, Chartered Environmentalist, and a Practitioner of the Institute of Environmental Management and Assessment (PIEMA) and Member of the Institute of Environmental Sciences (MIES).	BSc MSc PIEMA CEnv
EIA and Section 36 Application Management	Principal Consultant	A Chartered Town Planner and certified Institute of Environmental Management and Assessment (IEMA) Practitioner with more than 10 years' experience in delivering complex, time-constrained projects. Has expertise in planning and environmental legislation in the UK and has worked in private and public sector roles. Experience of preparing and reviewing EIAs in a range of sectors, with a specialism in renewable energy.	BA (Hons) MSc PIEMA MRTPI

Topic	Title	Description	Qualification
Landscape and Visual	Associate Landscape Architect	An Associate Landscape Architect in AECOM's UK business. Responsible for a small team of landscape architects based in the Chesterfield office. As a Chartered Landscape Architect with over 35 years' experience, he has wide-ranging experience of many types of design projects, landscape and visual impact assessment for a variety of development types, producing landscape character assessments and landscape mitigation strategies. Has given evidence at Public Inquiry on numerous occasions, including in relation to housing, windfarms, highways and minerals / waste projects. Has practical experience of the design and implementation of large-scale habitat creation.	BA(Hons) MA CMLI
Noise	Acoustics Regional Manager	Acoustic Consultant with over 20 years' experience of acoustic research and consultancy, providing advice and assessment on sound, noise and vibration to a wide range of public and private sector clients. Has provided expert acoustics technical support to the Department for Environment, Food and Rural Affairs on a range of topics since 2013. Other project experience includes undertaking noise impact assessments for a range of power, industrial, minerals, transportation (air, road and rail), residential and mixed used developments. Considerable experience of supporting projects for planning applications in England, Scotland and Ireland, and undertaking assessments as part of the EIA process.	MSci MA MIOA
Ecology	Principal Ecologist	Principal Ecologist with 15 years' experience of undertaking professional ecological work in a range of public and private sector client projects. Has extensive experience of habitat surveys and assessment, including National Vegetation Classification and condition assessment, as well as protected species survey, assessment and mitigation, including bats, otter, water vole, badger and pine marten. Has produced and contributed to Ecological Impact Assessments and Habitat Regulations Appraisal reports for a variety of energy- and transport-related projects.	BSc (Hons) MCIEEM

Topic	Title	Description	Qualification
Ornithology	Associate Director	An Associate Director who leads the AECOM ecology team in Scotland. He has more than 12 years' experience as a professional ecologist on projects for private and public sector clients. These have ranged from large-scale infrastructure developments to complex conservation projects and include Ecological (and Environmental) Impact Assessment (EcIA/EIA) and Habitats Regulations Appraisal (HRA).	MCIEEM
	Alan Fielding *[external to AECOM]*	Data scientist with more than 25 years' experience undertaking professional work for a diverse range of clients. Has extensive experience of windfarm impact assessments (>30), including acting as an advisor for government agencies. Has written windfarm and forestry guidance for Scottish Natural Heritage (SNH; now NatureScot) and is currently writing new guidance for NatureScot. Extensive research experience with ~70 peer reviewed papers or reports. Previously a member of the SNH Scientific Advisory Committee Experts Panel (2013-2021). Scientific advisor to all of the Irish raptor reintroduction schemes and the South of Scotland golden eagle reintroduction project. Lead author on the national golden eagle and hen harrier national conservation frameworks.	BSc (Hons) MSc PhD FLS
Geology, Hydrology and Hydrogeology	Associate Director	This assessment has been prepared by an Associate Director at AECOM, with a Master degree in Civil Engineering and over 10 years' experience in undertaking environmental impact assessments for renewable energy projects across the UK. He has specifically prepared environmental impact assessments on ground conditions and hydrology for wind farms in Scotland, including the impacts on peat, such as carbon loss.	MEng

Topic	Title	Description	Qualification
Cultural Heritage	Principal Heritage Consultant	Experienced cultural heritage specialist with over 15 years' experience in all aspects of heritage management and assessment. Has a diverse background in providing heritage advice and guidance having worked for clients including Local Authorities and the National Park Authority prior to joining AECOM. Lead on heritage input into EIA scoping, baselines and EIAR chapters, alongside offering planning and archaeological mitigation advice to clients and other stakeholders across the UK, as well as the Middle East and Africa. EIA work covers various sectors including renewables, infrastructure, and roads, and has also undertaken archaeological Clerk of Works roles on a number of large scale projects. Academic research includes the development of upland landscapes in Scotland and the Anglo-Scottish border, including transhumance and the concept of marginality.	BA (Hons) MLitt PhD ACIfA
Socio-economics, Recreation and Tourism	Senior Consultant	Senior consultant with over 6 years' working in planning and environmental assessment. Previous experience of socio-economic related assessment has included EIA projects for onshore wind and pumped storage hydro schemes, DMRB Environmental Options Assessments, and as part of multiple projects associated with the Defence Infrastructure Organisation's (MOD) Army Basing Programme.	MSc BSc (Hons) MRTPI
Traffic, Transport and Access	Associate Director	This assessment has been prepared by an Associate Director at AECOM with an Honours degree in Civil Engineering, a Masters degree in Transport Planning and Engineering, and a chartered member of The Institution of Highways & Transportation and the Institute of Logistics and Transport. He has over 30 years' experience in undertaking environmental impact assessments for development projects across the UK and has specifically prepared environmental impact assessments on transport for a wide range of development types, including wind farms.	BEng MSc MCIHT CMILT
Infrastructure and Telecomm-unications	Principal Consultant	Principal consultant with over 10 years' experience undertaking infrastructure and telecommunications consultation for development applications. This involves consulting with relevant service providers identified through scoping and initial searches to identify potentially affected assets.	BSc (Hons)

Topic	Title	Description	Qualification
Aviation Safeguarding	Commander John Taylor RN (Ret) Director (*Wind Power Aviation Consultants Ltd.*)	Senior Military Air Traffic Controller with over 30 years' experience in Air Traffic Control service provision, safeguarding, radar and aviation regulation at national and international level. Has been working with the wind farm and solar industry since 2008 and has assessed over 3,000 wind turbine proposals and given expert witness evidence at more than 20 Inquiries in England and Scotland. Provided advice to a number of local planning authorities, the Crown Estate and government departments.	RAF (Retd)
	Squadron Leader Mike Hale RAF Retired (*Wind Power Aviation Consultants Ltd.*)	Over 40 years and 9,000 hours of piloting, instructing and examining experience on aircraft such as Lightning, Phantom and Tornado, through to a range of civilian and military General Aviation craft. He also has 7 years as Chairman and Officer in Charge of a large Gliding Club. Over the last 8 years, in parallel to his flying duties, he has held the post of Ministry of Defence (MOD) Air Staff Low Level Airspace Manager & Wind-Farm Subject Matter Expert. He has assessed over 14,000 wind-farm applications against low flying, weapons range, specialist airspace and aerodrome safeguarding criteria. Mike has also managed two Air Staff Wind Farm Flight Trials for the MOD, Civil Aviation Authority, Renewable UK and Trinity House. In 2012, he was awarded an MBE for generating a proactive and mutually successful working relationship between the Wind Power Industry and the MOD Air Staff.	MBE MSc CFS RAF (Retd)
Forestry	Senior Consultant *[Wood]*	Forestry specialist with over 25 years' experience in both the forestry and renewables industries, including experience in the development of wind, hydro and biomass projects in the forest environment, together with the establishment and management of large areas of commercial and environmental forest.	BSc (Hons)
Shadow Flicker	Principal Consultant	Principal Consultant with over 10 years' experience undertaking shadow flicker assessments for wind farm applications. Has experience using EMD Wind Pro software to undertake the shadow flicker calculations and interpret results based on a number of different scenarios relevant to each specific site.	BSc (Hons)

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Appendix 5.1: Scoping Report

AECOM Imagine it. Delivered.

Clachaig Glen Wind Farm Section 36 Scoping Report

08 July 2020

Quality information

Prepared by	Checked by	Verified by	Approved by
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Revision History

Revision	Revision date	Details	Authorized	Name	Position
00	22 June 2020	Draft for client review	22 June 2020	Neil Titley	Technical Director

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1. Project Overview

Introduction

1.1 In December 2019, E.ON Climate & Renewables UK Developments Ltd (now RWE Renewables UK Developments Ltd) gained approval under section 47 of the Town and Country Planning (Scotland) Act 1997 and deemed planning permission from Scottish Ministers for a 47.6 megawatt (MW) wind farm at Clachaig Glen. The Consented Development comprises 14 wind turbines (13 with a blade tip height of up to 126.5m (and hub height of up to 80m) and one with a blade tip height of up to 115.5m (and hub height of up to 69m)) and associated infrastructure. The Development Site ('Site') is centred at National Grid Reference (NGR) (172190, 641550) and is located approximately 20 kilometres (km) to the North of Campbeltown and 1.8 km north east of the small hamlet of Muasdale on the western coast of the Kintyre Peninsula in Argyll and Bute with the general site location shown on Figure 1.1 in Appendix A.

1.2 RWE Renewables UK Developments Ltd (the 'Applicant')[1] is proposing to submit a new application under section 36 of the Electricity Act (1989) (as amended) to construct and operate a wind farm with a generating capacity in excess of 50MW on the existing site of the Consented Development. The Site boundary and turbine locations of the Consented Development and the 'Proposed Development' are largely identical. The Proposed Development comprises a reduction in turbines onsite with 12 now proposed (down from 14 under the Consented Development) and seeks an increased operational period of 35 years (the operational period is 25 years in the Consented Development). The Proposed Development proposes to increase the blade tip height of the turbines to a maximum 180m, up from the 126.5m maximum tip height in the Consented Development. The Proposed Development maximum rotor diameter is 140m, an increase from the Consented Development which looked to use rotors with a diameter of approximately 101m. The proposed increase in rotor diameters and blade tip height would increase potential renewable energy generation within the Site with only minimal changes proposed to the onsite infrastructure approved under the Consented Development.

1.3 This Scoping Report recognises Regulation 5(4) under The Electricity Works (Environmental Impact Assessment) (Scotland) Amendment Regulations December 2017, which states: *'With a view to avoiding duplication of assessments, account is to be taken of the available results of other relevant assessments in preparing the EIA report.'* Full details of the previous assessments undertaken for the Consented Development can be found in the *Clachaig Glen Environmental Statement Volume 2a: Main Text* and the associated figures in *Volume 2b* and in *Appendices 9.1 – 9.6* in *Volume 3* (2016 EIA). In order to prevent duplication, reference is given to the 2016 EIA where appropriate in order to highlight where additional assessment should not be required / scope for assessment should be limited in order to prevent duplication.

1.4 Under section 36 of the Electricity Act 1989 (as amended), the Proposed Development would require authorisation from the Scottish Ministers as it would require consent for a power generating station in excess of 50MW.

COVID – 19

It is acknowledged that there is uncertainty regarding the evolving Covid-19 situation and the impact that it might have on this project. First and foremost, we recognise that this is a public health issue and are committed to protecting the health and wellbeing of everyone involved. The Applicant and its supply chain will regularly review their processes and make adjustments to reflect the latest advice from the UK Government. Whenever it is not possible to proceed with the normal approach then the Applicant will consult with the relevant stakeholder or consenting authority to find a solution that all parties find agreeable. The Applicant, as the developer, takes

[1] E.ON Climate & Renewables UK Developments Ltd, the applicant for the Consented Development, was acquired by RWE Renewables on 30 September 2019. The legal entity remains the same, although the company name has been changed, and the applicant for the proposed section 36 development is the same entity as that of the original consent.

its commitments under statutory provisions very seriously and will aim to comply with standard practice and guidance where practicable.

Contents of this Report

1.5 This report sets out the proposed scope of the EIA for the Proposed Development, which is to be submitted to the Scottish Ministers as a formal request for a scoping opinion. A scoping opinion is defined under the EIA Regulations as "as opinion adopted by the Scottish Ministers as to the scope and level of detail of information to be provided in the EIA Report". The purpose of this Scoping Report is therefore to:

- Define the Proposed Development being considered;
- Describe the consenting and EIA requirements in relation to the Proposed Development; and
- Outline the aspects of the Proposed Development that could potentially result in significant environmental effects (Chapter 3) and, where potentially significant effects may result, the methodologies that will be used to assess potential impacts.

1.6 The following Figures accompany this Scoping Report in Appendix A:

- Figure 1.1: Site Location
- Figure 1.2: Red Line Boundary
- Figure 1.3: Site Layout
- Figure 1.4: Site Constraints
- Figure 1.5: Surrounding Wind Farms
- Figure 7.1: Blade Tip Zone of Theoretical Visibility
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- Figure 15.1: Infrastructure Assets
- Figure 16.1 Aviation Assets
- Figure 18.1: Shadow Flicker Study Area

2. The Applicant

2.1 The 'Applicant' is RWE Renewables UK Developments Ltd (the applicant for the Proposed Development is the same legal entity that sought and holds the benefit of the section 47 consent under the Town and Country Planning (Scotland) Act 1997 for the Consented Development, but the company name changed from E.ON Climate & Renewables UK Developments Ltd, further to the acquisition of the E.ON business by RWE Renewables on 30 September 2019).

2.2 RWE Renewables produces electricity from renewable energy sources and has become a "super player" in the field of renewables being the global number two in offshore wind. RWE has a goal to become climate-neutral by 2040. In order to achieve this goal, it is reducing its CO_2 emissions as quickly and drastically as possible, by phasing out or converting conventional power plants.

2.3 RWE Renewables is planning to invest billions of pounds net annually and match fund their investment in order to expand renewables and continue developing storage technologies. It is focusing on European core markets such as the UK.

3. Project Description

The Development Site

3.1 The proposed site as illustrated in Figures 1.1 – 1.3 and is located on the Kintyre peninsula, approximately 20km north of Campbeltown and 1.8km north east of the small hamlet of Muasdale and has an approximate area of 13.6km^2 (1,360 hectares (ha)). The A83 between Tarbert and Campbeltown (which passes through Muasdale on the western coast of Kintyre peninsula) is located approximately 1km to the west of the land available for turbine and associated access to the site can be gained from the A83 turning east onto existing forest roads to the south of Muasdale and at Killean, the latter of which is an existing access track used for the delivery of infrastructure and periodic maintenance access for the Deucheran Hill wind farm and was the approved access outlined in the 2016 EIA.

3.2 There are no public roads within the site itself, although there are a number of forest roads. There are a number of properties located within 3km of the site, including several isolated properties located adjacent to the west of the A83 associated with the small settlements of Muasdale, Beacharr and Glenbarr. The closest properties are located at North and South Beachmore, Crubasdale, Low Clachaig, High Clachaig, Aronod and Arnicle. The nearest residential property to a proposed turbine location is High Clachaig, which is located approximately 1220m from the closest turbine (Turbine 14). It is noted that under the Consented Development High Clachaig is located approximately 850m from Turbine 12 which has now been removed in the Proposed Development, resulting in an increased distance between residential properties and turbine locations.

3.3 The majority of the site is dedicated to commercial timber (sitka spruce) production owned by Forestry & Land Scotland (FLS) with the exception of the summit of Cruach Mhic an t-Saoir (on the eastern boundary of the site) and along the ridge to the south to an unnamed summit at 329m above ordnance datum (mAOD). The sitka spruce is in various stages of growth across the site with operations currently ongoing throughout. The upland areas of the site are dominated by common heather, blaeberry, and grass species with smaller areas of scrub including goat willow and bracken.

3.4 The southern part of the site area maintains height from the main eastern ridge at 250m to the south western part. From this ridge the ground falls steeply to 200m in a valley with Clachaig Water before rising to 318m to the north. This main valley, through the centre of which flows Clachaig Water (there are many minor watercourses which converge), falls to 140m at the western boundary of the site, and Clachaig Water continues west where it eventually meets the sea. The site contains a small loch in the crags on the eastern ridge part of the site. Loch na Naich is located outside of the site area but lies immediately adjacent between the land available for associated infrastructure and the existing forest roads. The Kintyre Way Long Distance Route passes the land available for associated infrastructure boundary approximately 200m to the north at the closest point.

3.5 The higher areas of the site offer views to the west, across to the Isle of Jura, which extend to the National Scenic Area to the north of the Island.

Background Context: Consented Development

3.6 The Consented Development comprises the construction, operation for a period of 25 years, and decommissioning of a wind farm with a maximum generating capacity of 47.6MW. It consists of 14 wind turbines (13 with a blade tip height of up to 126.5m (and hub height of up to 80m) and one with a blade tip height of up to 115.5m (and hub height of up to 69m)), maximum rotor diameter of 101m, upgrading of permanent access, turning circle on A83, formation of site access tracks, erection of permanent anemometer mast, control building and substation, watercourse crossings and temporary construction compound. The application was accompanied by the 2016 EIA prepared by AECOM and associated sub-consultants.

The Proposed Development

Rationale for the Development

3.7 The Clachaig Glen Wind Farm received consent from the Scottish Government, via Public Inquiry, in December 2019. Following consent, and as part of its review process, the Applicant has been analysing the site's capability to make best possible use of the wind resource on site; a guiding principle of which is seeking to assist and support the Scottish Government in its Climate Emergency declaration. In addition to this, the wind industry, and particular the technology, has evolved considerably since the original application was made in 2016. These important drivers have led the Applicant to pursue a larger scheme that seeks to maximise the wind resource using more modern and efficient turbines. Part of this process has included reviewing the entire Kintyre peninsula and that of Argyll in detail for potential sites that can accommodate larger turbines, and following that extensive review the Applicant is of the view that the Clachaig Glen site offers one of the best opportunities within the region whilst minimising and mitigating impacts.

Project Description

3.8 The Proposed Development would comprise the construction and operation of up to 12 wind turbines, in the same locations as for the Consented Development. The majority of infrastructure elements will largely remain in the same location / at the same scale as that in the 2016 Consented Development. Where changes in proposed site infrastructure may occur, annotation is provided in the below project description:

- Up to 12 wind turbines with the maximum rotor diameter being 140m and blade tip heights up to a maximum of 180m **(increase in tip height and rotor diameter);**
- Turbine foundations **(increase in size to accommodate larger turbines);**
- Potential battery storage within proposed substation or construction compound areas **(newly proposed);**
- Access tracks connecting infrastructure elements **(potential for widening and slight realignment within the approved micro-siting to accommodate increased turbine size);**
- Permanent Access: Upgrading of existing 6 km access track (in places) from A83 to the Site **(potential for widening to accommodate increased turbine size);**
- Hard standing areas e.g. crane pads;
- Temporary working areas e.g. construction compound;
- Control building and substation and electrical cabling between this and the turbines;
- Permanent Anemometer Mast (1 no.) located in original 2016 EIA position;
- Watercourse and Culvert Crossings;
- Potential aviation lighting on-top of nacelle **(newly proposed);**
- Passing Places;
- Small Temporary Quarries (borrow pits);
- Forestry; and
- Cable Trenches.

Wind Turbines

3.9 The candidate turbine models (and power output per turbine) would be selected through a competitive tendering exercise and as such these details of the Proposed Development have yet to be finalised. The proposed increase in maximum rotor diameter from approximately 101m to 140m and increase in maximum blade tip height from 126.5m to 180m will allow an increased generating capacity per turbine; and while the total installed capacity of the Proposed

Development will be confirmed once the turbine model is selected, it will exceed 50MW. It is noted that some individual turbines output in terms of GWHs will increase by 100% from that of the Consented Development if certain turbines within the layout were increased to 180m. f

3.10 The proposed maximum rotor diameter would not exceed 140m and the maximum tip height would be 180m. The indicative turbine coordinates remain unchanged from the Consented Development, as presented in Table 3.1, with the site layout shown on Figure 1.3.

Table 3.1: Proposed Development Turbine Locations

Turbine	Location
1	E: 172042 N: 643025
2	E: 173016 N: 642763
3	E: 171732 N: 642706
4	E: 171315 N: 642462
5	E: 172656 N: 642456
6	E: 171789 N: 642110
7	E: 172423 N: 642107
8	E: 171178 N: 642039
10	E: 170883 N: 641708
11	E: 171384 N: 641485
13	E: 171994 N: 641309
14	E: 171172 N: 641130

Note: *To allow ease of comparison between the Proposed and Consented developments turbine numbering has remained 1-14, with turbines 9 and 12 being removed in the Proposed Development.*

Electricity Storage Options

3.11 The Proposed Development is considering the inclusion of battery storage onsite to hold surplus electricity until periods of lower production, resulting in a more even diurnal production profile. If included, battery storage would occur within the proposed substation or construction compound areas. Furthermore, if approval is obtained for the Proposed Development the development of an associated green hydrogen production facility in response to demand from local heat and transport users would be considered and approval would be sought under a separate planning application.

Other Infrastructure

3.12 All other infrastructure elements will largely remain in the same location / at the same scale as that in the 2016 Consented Development. In order to accommodate larger turbines some elements will need to be modified e.g. turbine foundations increased and some access roads widened. Furthermore, due to the increased size in turbine tip height there is the potential requirement for aviation lighting on turbine nacelles and this is discussed further in Chapter 16.

Timeframes

3.13 The Proposed Development would be designed with an operational life of 35 years. Following this, provided there has been no approval to extend the life, it is expected that the wind farm would then be decommissioned.

4. EIA Process and Consultation

EIA Overview

4.1 EIA is a systematic process that must be followed for certain categories of project before they can receive development consent. It aims to identify a project's likely significant effects through the scoping process, and then assess those effects in an EIA Report. This helps to ensure that the importance of the predicted effects and the scope for mitigation measures to reduce them are properly understood by the public and, in this instance, the Scottish Ministers before they make their decision.

4.2 The EIA process should be systematic, analytical, impartial, consultative and iterative, allowing opportunities for environmental concerns to be addressed in the design of a project. Typically, a number of design iterations take place in response to environmental constraints identified during the EIA process prior to the final design being reached.

4.3 The EIA should be based upon recognised good practice and guidelines specific to each technical area and identify the likely significant environmental effects arising from a proposed development. Consultees are also encouraged to provide confirmation of agreement to the proposed scope in terms of what is included and excluded, the methodology and the receptors identified.

EIA Methodology

4.4 The EIA Report will identify the assessment methodologies based on recognised good practice and guidelines specific to each of the relevant environmental topic areas where the Proposed Development could result in significant effects. In general terms, the technical studies undertaken for each topic area and chapter included in the EIA Report to accompany the Proposed Development application would include:

- Baseline information about the receiving environment, largely based on the baseline presented within the 2016 EIA, together with identification of any relevant trends in, or evolution of, the baseline;
- Consultation with experts and relevant consultees as necessary;
- Consideration of the potential effects of the Proposed Development on the baseline, followed by identification of any additional mitigation measures to seek to avoid or reduce any predicted adverse effects;
- Assessment and evaluation of any residual significant effects after mitigation measures have been implemented; and
- Compilation of the EIA Report chapter.

Consultation

4.5 Consultation is an essential element of the EIA process and will be reported within the EIA Report and supporting documentation as necessary.

4.6 The Applicant is committed to engaging with statutory and non-statutory consultees and the local community, ensuring that all those with an interest in the Proposed Development is provided with an opportunity to view the proposals and importantly feedback their views directly to The Applicant.

Public Consultation for Planning Applications in light of COVID-19

4.7 At the time of submitting this Scoping Report the current Coronavirus (COVID-19) situation does not allow for traditional Public Exhibitions to be held. In accordance with Scottish Government guidance, The Applicant will therefore propose to hold an Online Consultation with an interactive online element that will replace the physical Public Exhibition. The Applicant will though monitor and adapt to changing Scottish Government guidance with regard to COVID-19. A Pre-

Application Consultation Report (PAC), that will detail the consultation undertaken, the feedback received, and how the Applicant, where possible, has responded to the comments received, will accompany the application for consent.

4.8 The exact consultation approach will consider the varying needs of residents and businesses as it is recognised not all members of the public will have access to the same level technology, so it is likely that a multifaceted approach will be taken so that consultation is fully inclusive.

4.9 The details around public consultation will be discussed with Argyll and Bute Council and the Energy Consents Unit (ECU) in due course.

Mitigation

4.10 Some mitigation measures to avoid, reduce or offset the consequences of the Proposed Development would be embedded within its design whilst others may require adherence to particular constraints on construction methodology or mode of operation. The final assessment of significance will take into account the mitigation measures and constraints that have been incorporated into the Proposed Development (i.e. it will be the assessment of residual effects).

Approach to Assessment

4.11 The following section describes the general approach to the assessment of effects within this EIA. The approach draws on guidance contained within 'A Handbook on Environmental Impact Assessment' (SNH, 5th edition, 2018) and the Guidelines for Environmental Impact Assessment (Institute of Environmental Management and Assessment, 2016).

4.12 The approach is broadly the same for all specialist topic areas with some variation in the sensitivity and magnitude categories, and in the descriptions of assessment criteria. The assessment of significance is generally informed by the sensitivity of the existing or baseline environmental conditions or character, and the magnitude of change (the change to the existing conditions or baseline character which occurs as a result).

4.13 Some technical chapters may deviate slightly from this general approach to adhere with industry standard guidelines.

Sensitivity of Importance of Receptors

4.14 The sensitivity of the baseline conditions is assessed according to the relative importance of existing environmental features on or near to the site, or by the sensitivity of receptors which would potentially be affected by the Proposed Development. Criteria for the determination of sensitivity or of importance or value of receptors are established based on approved guidance, legislation, statutory designation and/or professional judgment.

4.15 Table 4.1 provides general definitions of the sensitivity criteria used within the EIA. In each of the specialist chapters of the EIA, specific sensitivity criteria are defined with reference to that particular discipline and therefore may differ from those shown below.

Table 4.1: Sensitivity Criteria

Sensitivity	Definition
High	The receptor has low ability to absorb change without fundamentally altering its present character, and/or is of high environmental value or of national importance.
Medium	The receptor has moderate capacity to absorb change without significantly altering its present character, and/or has some environmental value or is of regional importance.
Low	The receptor is tolerant of change without detriment to its character, and/or is of low environmental value or local importance.

Negligible The receptor is resistant to change and is of little environmental value.

Magnitude of Change

4.16 The magnitude of potential impacts on environmental baseline conditions is identified through consideration of the Development, taking into account: the scale or degree of change from the existing situation as a result of the effect; the duration and reversibility of the effect; as well as consideration of relevant legislative or policy standards or guidelines.

4.17 Table 4.2 provides general definitions of the magnitude criteria used in the EIA. In each of the specialist chapters of the EIA, magnitude criteria are defined with reference to that particular discipline, and therefore may differ from those shown below.

Table 4.2: Magnitude Criteria

Magnitude	Definition
High	Total loss or major alteration to key elements/features of the baseline conditions such that post development character/composition of baseline condition will be fundamentally changed.
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition of the baseline condition will be materially changed.
Low	Minor shift away from baseline conditions. Changes arising from the alteration will be detectable but not material; the underlying character /composition of the baseline condition will be similar to the pre-development situation.
Negligible	Very little change from baseline conditions. Change is barely distinguishable, approximating to a 'no change' situation.

Significance of Effects

4.18 The approach to the assessment of significance is outlined in Table 4.3. A combination of the magnitude of the impact under consideration and the sensitivity of the receiving environment (receptor) guides the 'significance of effect'. It should be noted that this general approach is a framework and professional judgement is also applied to the assessment of significance.

Table 4.3: Significance Criteria

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

4.19 For the purposes of this Scoping Report, effects predicted to be 'Minor' or 'Negligible' are generally considered to be 'Not Significant'. Effects assessed as either 'Moderate' or 'Major' (shaded grey in Table 4.3 above) are generally considered to be 'Significant'.

4.20 The significance of the effects arising from the Development will generally be reported using a seven-point scale:

- Major Adverse;

- Moderate Adverse;
- Minor Adverse;
- None;
- Minor Beneficial;
- Moderate Beneficial; and
- Major Beneficial.

4.21 Some technical chapters have stipulated specific assessment criteria, which differs from the general approach described above. For example, where a professional institute has its own significance criteria for EIA.

4.22 'Potential effects' are defined as any effects that may occur as a result of the Proposed Development, prior to consideration of mitigation measures. The significance of 'residual effects' takes into account mitigation, i.e. it is an assessment of the effect that would remain following the implementation of committed mitigation measures.

4.23 Some variation from this general approach is required for specific environmental concerns but is summarised in the individual topic sections and confirmed during the EIA process in discussions with the relevant consultees.

Type of Effect

4.24 Potential effects have been separated into three types based on the different phases of development which will occur, taking account of potential secondary and cumulative as well as direct effects, as explained below.

Construction Effects

4.25 Construction effects are those that occur during the enabling, construction and commissioning stages. This will include effects resulting from construction of the Proposed Development as well as any effects resulting from other construction works such as temporary compounds. These are typically temporary short-term effects; however, some construction effects may be long-term effects.

Operational Effects

4.26 Operational effects are typically longer-term effects that would occur as a result of the Development, such as the land take associated with permanent physical wind farm infrastructure as well as effects which occur as a result of its operation.

Decommissioning Effects

4.27 Decommissioning effects are those effects that will occur during the decommissioning and removal of the wind farm infrastructure at the end of its 25-year operational lifetime. As with construction effects, these are typically temporary and short-term effects; however, some effects may be longer-term.

Indirect or Secondary Effects

4.28 For the purposes of the EIA, the potential effects of the Proposed Development are considered in terms of effects on each discrete environmental topic area. However, the inter-relationship between topic areas such as water quality and ecology mean effects cannot always be considered in isolation since changes affecting one factor may often have secondary implications for other areas.

4.29 For example, if one effect is to alter the quality of a watercourse, flora and fauna may be affected as a secondary effect. Under some circumstances, it is possible for the secondary or indirect effects to be more significant than the changes that triggered them. Where there is the potential for secondary or indirect effects this is highlighted and assessed in the EIA.

Cumulative and In-Combination Effects

4.30 Likely cumulative and in-combination effects on specific resources or receptors are described, where relevant, in each of the specialist chapters. Cumulative effects may occur where landscape and visual resources, land use or ecological receptors are affected by other developments in addition to the Proposed Development, for example where two effects could combine to result in a potential cumulative effect which is significant (or more than significant). In-combination effects occur when different effects combine onsite e.g. ecological and construction and result in an effect which is significant (or more than significant). Cumulative and in-combination effects will be considered within the EIA and are discussed where relevant within each scoping chapter.

Alternatives

4.31 The Regulations require that an EIA includes *'an outline of the main alternatives studied by the applicant or appellant and an indication of the main reasons for the choice made, taking into account the environmental effects'.* Layout options will be considered including candidate wind turbine models, the number and location of turbines, and battery storage design throughout the EIA process. The site infrastructure already approved under the Consented Development will largely stay the same as that in the Consented Development.

EIA Scoping

4.32 The results of the EIA process are reported in an EIA Report and Schedule 4(4) of the EIA Regulations specifies that it should describe:

"…factors…likely to be significantly affected by the development: population, human health, biodiversity (for example fauna and flora), land (for example land take), soil (for example organic matter, erosion, compaction, sealing), water (for example hydromorphological changes, quantity and quality), air, climate (for example greenhouse gas emissions, impacts relevant to adaptation), material assets, cultural heritage, including architectural and archaeological aspects, and landscape."

4.33 Regulation 4(2) of the EIA Regulations requires the interaction between these factors to be considered. In addition, Regulation 4(4) requires EIA Reports to consider:

"…the expected effects deriving from the vulnerability of the development to risks, so far as relevant to the development, of major accidents and disasters."

4.34 Establishing which aspects of the environment are likely to be significantly affected by a particular project is captured in the EIA scoping process, which aims to identify those aspects of the environment and associated issues that need to be considered when assessing the potential effects resulting from a proposed development. This recognises that there may be some environmental elements for which the project is unlikely to have a significant effect, and hence where there is no need for further investigation to be undertaken as part of the EIA.

4.35 This scoping report draws on existing baseline data and assessment work from the 2016 EIA to identify where significant effects are likely in terms of each of the relevant environmental topics. This provides a robust process to 'scope in' those environmental receptors where significant effects are likely as a result of the Proposed Development, and to 'scope out' those where significant effects are unlikely.

4.36 The proposed scope of the EIA for the Proposed Development is set out in the following chapters of this report. Potentially significant effects as a result of the Proposed Development are summarised for each environmental topic area[2], and any such effects would be carried forward into the relevant EIA Report chapter.

4.37 The scope is cognisant of The Electricity Works (Environmental Impact Assessment) (Scotland) Amendment Regulations December 2017 which make it clear that where appropriate reference should be given to previous assessments in order to highlight where additional assessment should not be required / scope for assessment should be limited in order to prevent duplication.

[2] Where an effect cannot be confirmed as being 'not significant' these will be 'scoped in' to the assessment.

As the Proposed Development primarily relates to an increase in rotor diameter and maximum blade tip height of turbines, with all other infrastructure, construction programme, decommissioning proposals etc. all largely remaining unchanged, the upcoming EIA will primarily focus on impacts likely to arise from the increased turbine size with the 2016 EIA referenced where possible to prevent assessment duplication. However, where deemed necessary updated baselines and impact assessments will be provided in individual chapters.

4.38 The elements scoped into the EIA are:

- Chapter 7 – Landscape and Visual Assessment;
- Chapter 8 – Noise;
- Chapter 9 – Ecology;
- Chapter 10 – Ornithology;
- Chapter 11 – Geology, Hydrology and Hydrogeology
- Chapter 12 – Cultural Heritage
- Chapter 13 – Socio-economics and Tourism
- Chapter 14 – Traffic, Transport and Access
- Chapter 15 – Infrastructure and Telecommunications
- Chapter 16 – Air Safeguarding
- Chapter 17 – Forestry
- Chapter 18 – Shadow Flicker; and
- Chapter 19 – Residual Effects and Conclusions

4.39 The scope and assessment methodologies proposed in the subsequent technical chapters of this scoping report are based on recognised good practice and guidelines specific to each topic area. The environmental topic chapters identify where significant effects are anticipated as a result of the Proposed Development and take into account:

- The baseline data from the 2016 EIA, where appropriate;
- The description of the Proposed Development;
- Changes to guidance on assessment methodologies (if any);
- Existing conclusions regarding significant effects for the Consented Development and the decisions made by the Scottish Ministers; and
- Any cumulative effects, which may arise.

5. Planning Policy Context

Introduction

5.1 The EIA will be progressed taking account of applicable legislation, policy and guidance. This chapter outlines the planning policy framework followed by an overview of further legislation, policy and guidance pertinent to the Proposed Development.

5.2 The section 36 application will be accompanied by a Planning Statement, which will set out the planning case for the Proposed Development with regards to local and national policies and other material considerations.

Regulatory Framework

5.3 The application for the Proposed Development would be made pursuant to section 36 of the Electricity Act 1989 (as amended).

5.4 Although the Proposed Development will be determined under Section 36 of the Electricity Act 1989 (as amended), the Scottish Ministers would also give a direction that planning permission for the development is deemed to be granted under Section 57 of the Town and Country Planning Act 1997 as amended.

5.5 The EIA Regulations provide the requirements for undertaking EIAs for developments to be consented under the Electricity Act 1989 (as amended). The EIA Report would be prepared in accordance with Schedule 4 of the Regulations.

5.6 Regard will also be given to The Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013, The Construction Design and Management Regulations 2015, and any other relevant subject-specific legislation, as identified within individual technical assessment chapters presented in the EIA.

Scottish Planning Policy & Guidance

5.7 There are legal, policy and advice documents which would be material considerations in the determination of the section 36 application for the Proposed Development, including those noted in the following sections:

National Planning Framework 3 (NPF3)

5.8 NPF3 (June 2014) provides the statutory framework for Scotland's long-term spatial development. It sets out the Scottish Government's spatial development priorities over a 20 to 30 year period, and what is expected of the planning system and the outcomes it must deliver. NPF3 reaffirmed the Scottish Government's commitment, at the time of publication, to renewable energy targets (30%) of overall energy demand from renewable sources by 2020 and recognises the important role of onshore wind in achieving these targets. The Framework supports the deployment of appropriately located onshore wind energy development. It should be noted that preparation for NPF4 is underway.

Scottish Planning Policy (SPP)

5.9 SPP (June 2014) sets out national planning policies that reflect the priorities of the Scottish Ministers for the operation of the planning system and the development and use of land through sustainable economic growth. The SPP recognises that renewable energy generation including onshore wind will contribute to more secure and diverse energy supplies and support sustainable economic growth. The commitment to increase the amount of electricity generated from renewable sources including onshore wind is a vital part of the response to climate change. It should be noted that the Scottish Government is currently undertaking a process to reform the planning policy and the intention is that the next version of SPP will be incorporated into the NPF and thus be a statutory requirement.

National Planning Advice, Circulars and Advice Sheets

5.10 National planning policy is supported by Planning Circulars, Planning Advice Notes (PANs) and Specific Advice Sheets and Ministerial / Chief Planning Letters to Planning Authorities, which set out detailed advice from the Scottish Government in relation to a number of planning issues. The PANs and Specific Advice Sheets considered relevant to the Proposed Development include:

- Planning and Noise (PAN 1/2011), March 2011;
- Planning and Archaeology (PAN 2/2011), July 2011;
- Community Engagement (PAN 3/2010), August 2010;
- Planning, Environmental Protection and Regulation (PAN 51), October 2006;
- Natural Heritage (PAN 60), January 2000;
- Sustainable Urban Drainage Systems (PAN 61), July 2011;
- Planning for Transport (PAN 75), August 2005;
- Water and Drainage (PAN 79), September 2006;
- Wind Farm Developments on Peat Land, May 2013;
- Specific Advice Sheet: Peatland Survey 2017: Guidance on Developments on Peat Land;
- Specific Advice Sheet (updated 28 May 2014): Onshore Wind Turbines;
- Spatial Planning for Onshore Wind Turbines – Natural Heritage Consideration, June 2015; and
- Chief Planner Letter regarding Energy Targets and Scottish Planning Policy, 2015.

Argyll and Bute Local Development Plan (2015)

5.11 At a local level the Argyll and Bute Local Development Plan (Adopted March 2015) envisages continued support for the development of renewable energy as an important environmental asset in Argyll and Bute and as part of the spatial strategy for Mid Argyll, Kintyre and the Islands.

5.12 Policy LDP Strat 1 – Sustainable Development sets out the Council's commitment to principles of sustainable development including reducing the areas carbon footprint and increasing energy efficiency. The Plan continues to support the development of renewables as a key sector in the local economy. Key Objective D expresses support for the continued diversification and sustainable growth of Argyll and Bute's economy, and identifies as a particular focus, the areas of sustainable assets including renewables.

5.13 Development proposals are also expected to be consistent with all other LDP policies and Supplementary Guidance where relevant, although the Council has yet to produce an updated spatial framework in accordance with SPP, paragraph 161.

5.14 More explicitly Policy LDP 6 – Supporting the Sustainable Growth of Renewables states that the Council will continue to support renewable energy developments where these are consistent with the principles of sustainable development.

5.15 Policy LDP DM1 – Development within the Development Management Zones defines a number of different Development Management Zones including outside settlements, Rural Opportunity Areas, the Countryside Zone and Very Sensitive Countryside and the types of development that will be supported in each zone including renewable energy development.

5.16 In addition, Policy LDP 10 – Maximising our Resources and Reducing Our Consumption states that the Council will support development proposals that seek to maximise the areas resources and reduce consumption by contributing to renewable energy generation.

5.17 Other relevant policies within the Argyll and Bute Local Development Plan include:

- Policy LDP3 (Supporting the Protection, Conservation and Enhancement of our Environment);

- Policy LDP5 (Supporting the Sustainable Growth of Our Economy);
- Policy LDP8 (Supporting the Strength of our Communities);
- Policy LDP9 (Development Setting, Layout and Design); and
- Policy LDP10 (Maximising our Resources and Reducing our Consumption).

5.18 It is acknowledged that Argyll and Bute Council are currently in the process of preparing their new Local Development Plan (LDP2). Consultation on this has ended and the next stage will be examination. The LDP2 is planned to be adopted in October 2021, which is beyond the scope of the planning application process for the proposed Development. Until LDP2 is adopted the statutory status of the current LDP remains.

Other Material Considerations

5.19 The Argyll and Bute Wind Energy Capacity Study *"aims to inform both strategic planning for wind energy development and to provide guidance on the appraisal of individual wind farm and wind turbine proposals."* The 2012 Study was updated in consultation with Scottish Natural Heritage (SNH) in 2017.

5.20 Argyll and Bute has also developed a Renewable Energy Action Plan to assist the authority in realising its vision for the development of renewable energy:

"Argyll and the Islands will be at the heart of renewable energy development in Scotland by taking full advantage of its unique and significant mix of indigenous renewable resources and maximising the opportunities for sustainable economic growth for the benefits of its communities and Scotland"

5.21 In December 2017 the Scottish Government published a Planning Bill outlining potential changes to the Scottish planning system. This includes possible changes to the content of LDs and how they are prepared, and a broadening of the issues covered by national policy namely SPP.

Pre-Application Consultation Report

5.22 The Pre-Application Consultation Report (PAC) will explain in detail the statutory consultation programme undertaken by the Applicant to consult on the Proposed Development. Consultation will occur with local residents, stakeholders and elected members and the list of consultees' will be agreed with the ECU.

6. Renewable Energy Policy

Introduction

6.1 The EIA will be progressed taking account of applicable legislation, policy and guidance in relation to renewable energy. This section of the EIA Report will set out the policy and energy target context for renewable energy projects from a European, UK and Scottish perspective as well as providing the carbon balance assessment.

Renewable Energy & Climate Change Policy Framework

6.2 The following legislation and policy are relevant to the Proposed Development and would be considered in the EIA Report:

- Climate Change (Emissions Reduction Targets) (Scotland) Act 2019;
- The Renewable Energy Directive (2009/28/EC);
- The EU 2030 Climate & Energy Policy Framework;
- Climate Change (Scotland) Act 2009;
- Low Carbon Economic Strategy for Scotland 2010;
- Low Carbon Scotland – Meeting the Emissions Reductions Targets 2013-2027;
- The Scottish Government Renewables Action Plan June 2009 and 2011;
- Electricity Generation Policy Statement 2013;
- 2020 Renewables Routemap June 2011, updated October 2012 and December 2013;
- The Scottish Energy Strategy 2017
- Onshore Wind Policy Statement 2017; and
- The Climate Change Plan 2018.

Potential Contribution of the Proposed Development to Government Objectives

6.3 The Scottish and UK legislative and policy framework on climate change is shaped by international climate change legislation. These incorporate binding targets in the reduction of greenhouse gas emissions and in the generation of energy from renewable sources.

6.4 In 2019, the Scottish Government amended the Climate Change (Scotland) Act 2009 through the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019. The 2019 Act seeks to ensure Scotland achieves its ambition to reduce greenhouse gas emissions to a net-zero state by 2045. In order to achieve this ambition, Scotland will need considerably more renewable energy projects.

6.5 The Proposed Development would utilise more recent turbine technology than assumed at the time of the planning application for the Consented Development, which in turn would increase the renewable energy yield and maximise generation within the same footprint. This would make an important and substantial contribution to achieving multiple existing targets regarding the deployment of renewable energy technologies and greenhouse gas emissions reduction in pursuit climate change mitigation.

7. Landscape and Visual Impact Assessment

Introduction

7.1 The Landscape and Visual Impact Assessment (LVIA) undertaken in the 2016 EIA[3] for the now consented Clachaig Glen Wind Farm concluded that significant impacts would be limited to a localised part of one Landscape Character Type (LCT) (Upland Forest Moor Mosaic), and a relatively small number of visual receptors within the study area.

7.2 The Proposed Development to which this scoping report relates involves an increase in the height of the turbines (up to 180m tip height) from that assessed in the 2016 EIA (126.5m tip height). A revised LVIA will be undertaken and will form one chapter of the upcoming EIA Report. The LVIA will identify and assess potential effects of the Proposed Development on the landscape character and visual amenity of the site and surrounding areas.

Baseline Conditions

7.3 The Proposed Development is located within the upland interior of the Kintyre Peninsula, approximately 20 km to the north of Campbeltown and 1.8 km north east of Mausdale.

Landscape Character

7.4 The landscape of this area is one of considerable variation in character, ranging from smaller scale intimate and enclosed landscapes of the hidden glens to the large-scale open uplands of Kintyre and Knapdale and the rugged uplands of Arran. This area also includes a range of nationally and locally designated landscapes, such as National Scenic Areas (NSA) on Arran, Knapdale, Jura and at the Kyles of Bute, Wild Land Areas (WLA) on Arran and Jura, and several Gardens and Designed Landscapes (GDL) and Areas of Panoramic Quality (APQ).

7.5 The Proposed Development would be located within the Upland Forest Moor Mosaic LCT which is the most extensive LCT within the study area, covering the upland interior of Kintyre. The uplands consist of an elevated undulating to rolling plateau landscape which covers much of the peninsula and contain a mix of large productive coniferous forestry and moorland. A number of existing wind farms are present within these uplands and as such they are an existing characteristic of this landscape.

7.6 The Proposed Development itself is within an area of commercial forestry and moorland with a rolling topography, consistent with the character of the wider upland landscape within which it is located. The undulating nature of the site and the surrounding topography provides an element of visual containment of the site and emphasises the separation between the upland location and the settled coastal landscapes to the west.

Visual Amenity

7.7 Potential visual receptors within the study area include residents, tourists, road users, walkers and cyclists, boat users and ferry passengers. Settlement and potential receptors are largely located in the lower lying and coastal landscapes, with very few in the more inaccessible upland areas. This pattern of receptor locations is particularly evident on Kintyre where settlement, residential properties and roads are predominantly found along the coast and the lowland farmland west of Campbeltown. Within these areas, settlement is focused on Campbeltown and a number of smaller villages along the east and west coasts, with scattered farms and properties between.

7.8 The main road network comprises the A83, along the east coast, and the B842 along the west coast, linked in the north by the B8001 which crosses the peninsula. A number of ferry routes are found within the study area, connecting Kintyre with Arran to the east and Gigha, Islay and on to

[3] Clachaig Glen 2016 Environmental Impact Assessment

Jura in the west. The main recreational routes on the peninsula are the Kintyre Way and National Cycle Route 78 which follows the B842 along the east coast.

Methods

7.9 The method of assessment will generally follow the methodology of the LVIA in the 2016 EIA, except where updated best practice guidance or other factors require consideration. It will also take a more targeted approach to the identification and inclusion of receptors, focused on those with the potential for significant effects.

7.10 The LVIA will be carried out in accordance with current guidance and best practice documents including the Guidelines for Landscape and Visual Impact Assessment[4] (GLVIA) and other relevant guidance issued by SNH, Argyll and Bute Council and the Scottish Government. The LVIA will be undertaken based on the following four key steps:

- Identification of the baseline conditions;
- Assessment of the sensitivity to change;
- Assessment of the magnitude of impact; and
- Determination of the level and significance of effects.

7.11 Wind farm development would introduce a number of new and large-scale elements into the landscape, and therefore have the potential to influence landscape character and visual amenity. The LVIA will include the consideration of the following potential effects on landscape character and visual amenity:

- physical effects on the landscape fabric within the site area;
- effects on the impression and character of the landscape;
- effects on views and visual amenity.

7.12 The assessment will consider temporary effects during construction/ decommissioning and long-term effects during the operational phase of the wind farm.

Study Area

7.13 An initial study area of 45 km from the outermost turbines will be used for the LVIA, as recommended by SNH Guidance[5]. The LVIA in the 2016 EIA concluded that significant landscape effects would be limited to within approximately 2km and significant visual effects limited to within less than 10km. An analysis of Zone of Theoretical Visibility (ZTV) diagrams for the Proposed Development indicates a similar extent and pattern of visibility to the consented scheme. A detailed study area of between 15 - 20 km is therefore proposed for the LVIA. This extent of study area acknowledges the potential for increased impacts as a result of the taller turbine height while also ensuring a more targeted and proportionate approach focused on potential significant effects. Tip height and hub height ZTVs for the Proposed Development are provided in Figures 7.1 and 7.2. A comparative ZTV showing the extents of theoretical visibility of the consented scheme and the Proposed Development is provided in Figure 7.3.

Baseline and Assessment

7.14 It is anticipated that the baseline will be broadly similar to that presented in the 2016 EIA and updated for the 2019 Public Inquiry. However, on site appraisal will be undertaken as part of the assessment process in order to verify and update the baseline to take account of more recent changes. The baseline will provide a description of all landscape and visual receptors found within the detailed study area (15 - 20 km) and subject to potential visibility as indicated by the ZTV and observations in the field.

[4] Landscape Institute and IEMA (2013) Guidelines for Landscape and Visual Impact Assessment, Third Edition
[5] SNH (2017) Visual Representation of Wind Farms, Version 2.2, February 2017

Landscape Character

7.15 The landscape baseline will include a description of relevant national and local landscape designation and will be informed by an understanding of their key features and special qualities. As with the 2016 EIA, due to the distance from the Proposed Development it is proposed that any requirement for a separate Wild Land Assessment for the North Arran and Jura WLAs is scoped out. We also propose using the same LCT boundaries as those used in the 2016 EIA, which were informed by studies published by SNH and local wind farm capacity studies, including the Argyll and Bute Landscape Wind Energy Capacity Study[6] (ABLWECS).

Visual Amenity

7.16 The visual assessment will be based on a series of 17 viewpoint locations, as detailed in Table 7.1 and shown on Figure 7.1. These viewpoints have been chosen to provide a representative cross section of receptor types and locations within the study area, focused on those with the potential for significant effects. The previous list of 30 viewpoints which were selected prior to reaching final design of the layout and visible from a number of the locations has either been designed out or minimised so that only the tops of a small number of turbines are visible. In addition, there were a number of closely clustered viewpoints, or multiple viewpoints serving the same or similar receptors which have now been rationalised to give a more representative cross section. The viewpoints have been selected from those agreed with statutory consultees for the 2016 EIA and represent a refined list of locations to allow a more focused assessment of likely significant effects. Details of all of the 2016 EIA viewpoints are included in Table 7.1 indicating which we proposed to include or exclude from the LVIA scope and providing a justification for the approach taken in each case. Additional information can be provided to further support the justification for removal of viewpoints, if necessary.

Table 7.1: Viewpoint Locations

No	Viewpoint	Grid Reference	Included (Yes or No)	Reason for Inclusion or Exclusion
1	Kintyre Way	174336 643968	Y	Representative of recreational receptors close to the site. Within Upland Forest Moor Mosaic LCT.
2	North Muasdale	168136 639771	Y	Representative of residential receptors east of Mausdale and users of the local core path network. At edge of Upland Forest Moor Mosaic LCT and Rocky Mosaic LCT.
3	Tayinloan Ferry Terminal	169336 646531	Y	Representative of views from the ferry terminal. Within West Kintyre APQ and Coastal Plain LCT.
4	A83 near Bellochantuy	166040 632191	Y	Representative of views from A83 travelling north. Within West Kintyre APQ and Coastal Plain LCT.
5	Glenbarr war memorial	167018 637060	N	Excluded due to layout design resulting in very limited nature of visibility, with no potential for significant effects. Adjacent VP8 represents a location with greater visibility.
6	Sound of Gigha	164905 640419	Y	Representative of recreational watercraft in Gigha Sound.
7	Beinn an Tuirc	175227 636171	Y	Representative of views from hilltops to the south east. Within Upland Forest Moor Mosaic LCT.

[6] Argyll and Bute Council (2017) Argyll and Bute Landscape Wind Energy Capacity Study

8	Glenacardoch	166611	637290	Y	Representative of nearby residential receptor. Within Rocky Mosaic LCT.
9	Glenbarr	167060	636657	N	Excluded due to layout design resulting in very limited visibility, with no potential for significant effects. Adjacent VP8 represents a location with greater visibility.
10	Rhunahaorine/ Caravan Park	169530	648419	Y	Representative of visitors to the caravan park and beach. Within West Kintyre APQ and Coastal Plain LCT.
11	B842 south of Grogport	180330	643024	N	Excluded due to layout design resulting in very limited nature of visibility, with no potential for significant effects.
12	Sound of Gigha, Gigha Ferry	167781	647310	Y	Representative of views experienced by passengers on the ferry to Gigha.
13	Beinn Bhreac	179051	647586	N	Excluded as little visited hilltop within the centre of Cour Wind Farm. No potential for significant effects.
14	Gigha South Pier	164367	646364	N	Excluded as very similar to, but less sensitive than VP15.
15	Ardminish, Isle of Gigha	164897	648661	Y	Representative of views from the Isle of Gigha. Within Coastal Parallel Ridges LCT.
16	Sgreadan Hill	174118	629556	N	Excluded as broadly similar to VP7, and more distant with more limited visibility.
17	A841, Whitefarland	186619	642533	Y	Representative of low-level views from Arran. Within Arran NSA and Arran Raised Beach Coast LCT.
18	Kennacraig – Islay Ferry	169850	656946	Y	Representative of views experienced by passengers on the ferry to Islay.
19	A83 Approach to Clachan	177920	657558	Y	Representative of views from A83 travelling south. At edge of Upland Forest Moor Mosaic LCT and Rocky Mosaic LCT.
20	Beinn Bharrain	189441	642220	Y	Representative of elevated views from Arran. Within Arran NSA, WLA and Arran Rugged Granite Uplands LCT.
21	B8024 south of Kilberry	171529	661643	Y	Representative of road users and cyclists on the B8024 and NCR 78. Within Knapdale APQ and Rocky Mosaic LCT.
22	Kennacraig - Port Ellen Ferry	153598	648807	N	Excluded as from the same receptor as VP18 (Islay Ferry) but at a greater distance.

23	Lochranza - Claonaig Ferry	190597	652727	Y	Representative of views experienced by passengers on the ferry to Arran.
24	Machrie Moor	189795	632905	N	Excluded due to layout design resulting in limited visibility, with no potential for significant effects. VP17 demonstrates visibility from low lying areas on Arran.
25	Machrihanish (on Kintyre Way)	163147	619181	N	Excluded due to distant nature of location and layout design resulting in limited visibility, with no potential for significant effects.
26	B842 south of Stewarton	168420	617440	N	Excluded due to layout design resulting in no visibility.
27	Cnoc a' Bhaile Shios	186359	662853	N	Excluded due to distant nature of location, with a series of other wind farms in the foreground. No potential for significant effects.
28	Islay, Ardbeg Distillery	141596	646153	N	Excluded due to distance nature of location, with no potential for significant effects.
29	Quien Hill Viewpoint	205088	658866	N	Excluded due to distant nature of location and layout design resulting in limited visibility, with no potential for significant effects.
30	A83 (BT Car Park)	167244	638746	Y	Representative of views from A83 travelling north. Within West Kintyre APQ and Coastal Plain LCT.

Visualisations

7.17 A series of visualisations will be produced for each viewpoint in order to assist understanding of potential visual effects. This will include 90° baseline panorama(s), consisting of a baseline photograph and cumulative wireline; and a separate 53.5° wireline for each viewpoint and a 53.5° photomontage for those viewpoints within 10km. The exception to this is Viewpoint 30, where it is not possible to safely capture baseline photograph and therefore only wirelines will be provided. We propose to utilise existing viewpoint photography captured for the 2016 EIA and 2019 Public Inquiry for the visualisations. The methodology for the preparation and presentation of the visualisations will follow the requirements set out in SNH guidance[7].

Cumulative

7.18 The approach to the cumulative landscape and visual assessments will generally follow the methodology of the cumulative LVIA in the 2016 EIA. An initial cumulative search area of 60 km from the Proposed Development will be utilised for the identification of a long list of other existing, consented and application stage wind farms. We propose excluding those developments at scoping stage and those consisting of less than three wind turbines and/ or with a tip height of less than 50m. The consented Clachaig Glen Wind Farm will not be included within the cumulative assessment. As with the 2016 EIA we propose including only those wind farms with the potential to contribute to significant cumulative effects in combination with the Proposed

[7] SNH (2017) Visual Representation of Wind Farms, Version 2.2, February 2017

Development. A list of cumulative wind farms that we propose to include in the assessment is provided in Table 7.2, below.

Table 7.2: Wind Farms proposed to be included in Cumulative LVIA

Name	Status	No. of Turbines	Approximate Distance (km)
Airigh	Consented	14	22.1
Auchadaduie	Operational	3	5.1
Beinn an Tuirc	Operational	46	4.7
Beinn an Tuirc Extension	Operational	19	6.6
Beinn an Tuirc Phase III	Consented/ Under Construction	18	8.6
Blary Hill	Consented/ Under Construction	14	3.9
Cour	Operational	10	7.3
Deucheran Hill	Operational	9	2.6
Eascairt	Consented / Under Construction	13	15.6
Freasdail	Operational	11	18.0
Gigha and Leim Farm	Operational	4	8.8
Narachan	Application	17	4.0
Sheirdrim	Application	19	16.0
High Constellation	Consented	10	8.7
Tangy and Extension	Operational	22	12.7
Tangy IV	Consented	16	11.7

7.19 In acknowledgement of the uncertainty and unlikelihood of all identified cumulative schemes being consented and becoming operational the cumulative assessment will include consideration of the following two scenarios:

- Scenario 1 – The addition of the Proposed Development to a cumulative baseline consisting of consented schemes (in addition to existing); and
- Scenario 2 – The addition of the Proposed Development to a cumulative baseline consisting of consented and application stage schemes (in addition to existing).

7.20 The cumulative assessment will be supported by cumulative ZTVs based on the above two scenarios, helping to demonstrate any combined or additional theoretical visibility of the Proposed Development in comparison to each future baseline scenario. Cumulative wirelines will also be provided for each of the proposed representative viewpoints.

Night-time Lighting Assessment

7.21 As the Proposed Development includes turbines of up to 180m height it is likely that visible lighting would be required to ensure aviation safety. We therefore anticipate the requirement for the LVIA to consider potential landscape and visual effects resulting from lighting. A lighting strategy will be developed with an Aviation specialist and various mitigation measures considered in order to reduce potential effects. This strategy will form the basis of the assessment and accompanying visualisations.

7.22 It is anticipated that the extent of the assessment will be informed by analysis of ZTVs and will focus on a select number of key receptor locations. A hub height ZTV is included in Figure 7.2. The assessment will be presented in an appendix to the LVIA and will include details of the locations and intensity of lighting, ZTV diagrams, details of the number of lights visible from each of the included viewpoints and visualisations from up to two viewpoints. The detailed scope of the night-time lighting assessment will be determined through further consultation as the lighting strategy progresses. A hub height ZTV is included in Figure 7.2, giving a worst-case indication of where turbine hubs and therefore lights might be seen from. This ZTV does not take account of the reduction in intensity and visibility of lighting with distance.

Potential Significant Effects

7.23 The LVIA for the consented Clachaig Glen Wind Farm identified that significant impacts would be limited to a localised part of the Upland Forest Moor Mosaic LCT and a relatively small number of visual receptors. In general terms taller turbines are likely to be more visible and therefore have a greater influence on landscape character and visual amenity. In the case of the Proposed Development, initial ZTV and wireline analysis has indicated that the increased height of the turbines results in relatively minor changes in the extent and nature of visibility of the Proposed Development. This is demonstrated by the comparative ZTV shown in Figure 7.3, which indicates a broadly similar extent of visibility, with the main increase in extent focused on offshore areas and smaller, generally remote, upland areas on Kintyre. Although further detailed assessment is required, initial indications are that significant effects are likely to be largely similar in scope to those identified in the 2016 EIA, and principally include part of the Upland Forest Moor Mosaic LCT and a relatively small number of visual receptors to the west, including those on the Isle of Gigha.

7.24 One key difference resulting from the increased height of turbines will be the likely requirement for aviation lighting to be included on some or all the turbines. There is potential for this lighting to contribute to significant landscape and visual effects on some receptors.

Mitigation Measures

7.25 Landscape and visual mitigation measures are largely embedded in the scheme design and are a combination of a robust site selection process and careful consideration of landscape and visual impacts in designing the layout. The initial site selection process included analysis of the whole of the Kintyre peninsula using a computerised model that considered a large number of receptors within the immediate and surrounding areas. It is these factors and the use of surrounding topographical features to limit potential visibility from Kintyre and particularly from the settled coastal areas that ensure a reduced extent of significant effects.

7.26 As the Proposed Development will largely occupy the same footprint as the consented scheme, no additional mitigation measures are currently anticipated to those detailed in the 2016 EIA. The exception to this is the potential for incorporation of newly emerging technologies, such as radar activation systems to reduce and mitigate impacts related to aviation lighting on turbines. Other measures such as directional shielding or reduced intensity lights or a cardinal or perimeter lighting strategy will also be considered.

Summary and Conclusions

7.27 We propose to adopt a broadly similar approach to the LVIA employed for the 2016 EIA, updating it as necessary to accord with recent best practice. Based on analysis of the ZTV plans and our detailed knowledge of the study area we have proposed a refined list of viewpoints to allow a

targeted and proportionate assessment, focused on potential significant effects. These viewpoints will form the basis of the visual assessment and cover a range of different receptor types and locations throughout the detailed study area. A similarly proportionate approach to assessment is proposed for the landscape assessment, focusing on those receptors within a detailed study area of between 15 - 20 km. The cumulative assessment will include a short list of wind farms with the potential to contribute to significant cumulative effects. These largely comprise of schemes found on Kintyre but also include the existing scheme on Gigha and a recently consented scheme in the south of Knapdale.

7.28 Much of the embedded mitigation achieved through site selection and layout design remains as previous. These measures in conjunction with evaluation of ZTV and other analysis indicates that the extent of significant effects of the Proposed Development are likely to be similar to those of the consented scheme. However, further detailed assessment, including of night-time lighting, is required in order to determine the full extent of likely significant landscape and visual effects related to the increased turbine height.

References

2016 Clachaig Glen Environmental Impact Assessment

Landscape Institute and IEMA (2013) Guidelines for Landscape and Visual Impact Assessment, Third Edition

SNH (2017) Visual Representation of Wind Farms, Version 2.2, February 2017

Argyll and Bute Council (2017) Argyll and Bute Landscape Wind Energy Capacity Study

8. Noise

Introduction

8.1 The noise impact assessment will identify and assess potential noise effects of the Proposed Development on Noise Sensitive Receptors (NSRs). The assessment will be undertaken in accordance with ETSU-R-97 – 'The Assessment and Rating of Noise from Wind Farms' and the Good Practice Guide published by the Institute of Acoustics in 2013 (IOA GPG).

8.2 Noise impacts could arise from three distinct areas of a wind farm development:

- Construction and decommissioning of the wind farm;
- Operation of the wind farm; and
- Increased traffic flow during the construction, operational and decommissioning phases.

8.3 This chapter refers to the Noise chapter of the EIA which accompanied the planning application for the consented Clachaig Glen 2016 wind farm (2016 EIA).

Baseline

8.4 The assessment of the Proposed Development will rely on the baseline data collected to inform the 2016 EIA and no further baseline data collection is proposed. This assumes that the baseline noise levels have not changed significantly since the Noise Impact Assessment (NIA) survey in 2015. Any change in baseline noise levels is likely to be due to either new noise emitting development or increases in road traffic flows or aircraft movements. Such changes are likely to have had either a negligible effect or increased the baseline noise levels; therefore, adopting the 2016 survey data ensures a conservative, worst-case assessment.

8.5 There are several existing and proposed wind farm developments within 10km of the Proposed Development. A summary of these wind farms is presented in Table 8.1 and Figure 8.1.

Table 8.1: Wind Farms within 10km of Clachaig Glen

Site	No of Turbines	Hub Height (m)	Status	Turbine Type	Assumed Turbine Type
Auchadaduie	3	60	Operational	Vestas V80	Yes
Blary Hill	14	70	Under construction; approved	Nordex N90	No
Beinn an Tuirc	46	40	Operational	Vestas V47	No
Beinn an Tuirc Extension	19	58.5	Operational	Siemens SWT82 2.3	No
Beinn an Tuirc Phase III	18	81	Under construction; approved	VS93 2.3 MW	No
Deucheran Hill	9	46/60	Operational	Vestas V66	No
Cour	10	65	Operational	Senvion MM92	No
Isle of Gigha	4	30	Operational	Enercon E33	No
Gigha	3	30	Operational	Vestas V27	No
High Constellation	10	82	Consented	Nordex N133 4.8 MW	No
Narachan	17	112	Application	Vestas V150 5.6 MW	No

8.6 Scoping requests have been submitted to Argyll and Bute Council (ABC) for the Ronachan, Stewartfield and Willow wind farms, which are all within 10km of the Proposed Development. These developments have been at the scoping stage since 2015 or earlier and it is considered highly likely that a new scoping request would be required if they were to be progressed further in the planning process. Furthermore, according to the online ABC planning portal, planning applications have not been submitted for these developments. Therefore, the final turbine numbers, dimensions, layout, types, and noise emission levels are not available. It is not therefore possible to assess the cumulative noise impact of these developments and they will not be included in the assessment.

8.7 As part of the 2016 EIA, noise measurements were undertaken at the locations shown in Table 8.2 and Figure 8.2.

Table 8.2: 2016 EIA Baseline Noise Measurement Locations

Location	Coordinates	
	X	Y
Beacharr	169383	643197
North Beachmore	168873	641897
North Crubasdale	168737	641124
High Crubasdale Farm	169058	640638

8.8 The existing noise sensitive receptors (NSRs) likely to be most exposed to the noise emissions from the Proposed Development are detailed in Table 8.3 and illustrated in Figure 8.2. These NSRs represent the properties which are closest to the Site and which will therefore be exposed to the highest noise levels from the Proposed Development. Hence worst-case impacts are considered; impacts at other NSRs in the vicinity will be less significant than those identified at these locations. These NSRs are also those at which noise level limits were agreed with the ABC Environmental Health Officer (EHO) for inclusion in the planning consent for the approved 2016 Clachaig Glen wind farm application and were the agreed planning condition levels granted in the 2019 appeal decision.

Table 8.3: Identified NSRs

NSR	Easting	Northing	ES NIA Representative Monitoring Location
The Braids	171851	644762	N/a
Beacharr	169345	643214	Beacharr
North Beachmore	168900	641964	North Beachmore
North Crubasdale	168734	641141	North Crubasdale
High Clachaig	169985	640844	High Crubasdale Farm
Low Clachaig	169494	640379	High Crubasdale Farm

8.9 Baseline noise levels at The Braids are assumed to be the same as those measured at the location referred to as Culfuar in the Technical Appendix 3.1 – Braids to the Environmental Statement for the proposed Killean Wind Farm. This approach was agreed with the ABC EHO at the time of discussions between the developers of the Killean and Clachaig Glen wind farms which were considered concurrent applications. It formed the basis of the proposed Clachaig Glen wind farm consent noise level limits at this property.

Methods

Baseline

8.10 The baseline noise level data measured as part of the upcoming EIA application will be re-processed to identify baseline noise levels correlated to standardised to 10m above ground from the Proposed Development hub height. Measured wind speed at two heights (one of which is >60% of the proposed hub height) during the baseline survey will be used to determine the hub height wind speed. This is in accordance with method (b) detailed on page 10 of the IOA GPG.

Proposed Operational Noise Assessment Methodology

8.11 *Planning Advice Note 1/2011: Planning and Noise (PAN 1/2011)* and its associated Technical Advice Note provides guidance on planning and noise in Scotland. With regard to wind farm assessments PAN 1/2011 refers to the Scottish Government's document 'Onshore Wind Turbines'(Onshore wind turbines information (First published February 11, 2011 updated January 27, 2012, March 14, 2012 and last updated May 02, 2012)). This document states that:

> *"The Report, 'The Assessment and Rating of Noise from Wind Farms' (Final Report, Sept 1996, DTI), (ETSU-R-97) describes a framework for the measurement of wind farm noise, which should be followed by applicants and consultees, and used by planning authorities to assess and rate noise from wind energy developments, until such time as an update is available. This gives indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable burdens on wind farm developers, and suggests appropriate noise conditions."*

8.12 ETSU-R-97 recommends that the current practice on controlling noise from wind turbines is by the application of noise limits at neighbouring dwellings. It provides noise limits for the daytime and the night-time periods that are derived from measured background noise levels for the quiet periods of the day and during the night. The derived noise limit criteria (in terms of L_{A90}) are set at 5 dB(A) above the L_{A90} background noise level, subject to a lower limit between 35 to 40 dB(A) during the day and 43dB(A) at night.

8.13 The appropriate criteria to apply when assessing the noise effects associated with the proposed development will be determined from the guidance described above. Where appropriate, the noise assessment methods will be supplemented with the latest guidance contained in Institute of Acoustics (IOA) publication A Good Practice Guide to the Application of ETSU-R-97 for the *Assessment and Rating of Wind Turbine Noise* (Issue 1, May 2013) (IOA GPG).

<u>Low Frequency Sound, Infrasound and Ground-Borne Vibration</u>

8.14 Bowdler et al (2009) presented a review of published literature and concluded that "there is no robust evidence that low frequency noise (including infrasound) or ground-borne vibration from wind farms generally has effects on wind farm neighbours". It is therefore proposed that low frequency noise is excluded from the assessment.

<u>Amplitude Modulation (AM) of Aerodynamic Noise</u>

8.15 Wind turbine AM noise tends to occur only under certain meteorological conditions and is likely to manifest at only a minority of wind farms. Two forms of Amplitude Modulation of wind turbine aerodynamic noise have been identified, namely, 'Normal' Amplitude Modulation (NAM) and 'Other' Amplitude Modulation (OAM).

8.16 Wind turbine AM noise tends to occur only under certain meteorological conditions and is likely to manifest at only a minority of wind farms. Two forms of Amplitude Modulation of wind turbine aerodynamic noise have been identified, namely, 'Normal' Amplitude Modulation (NAM) and 'Other' Amplitude Modulation (OAM).

8.17 The sound level from turbine blades is often not completely steady but is modulated (fluctuates) in a cycle of increased and then decreased levels of noise, sometimes called "blade swish".

Typically, the modulation depth may be up to 2-3 dB. This is the normal form of amplitude modulation (NAM) and is accounted for in the ETSU-R-97 derived noise limits.

8.18 However, it is possible that under certain conditions the modulation depth may increase to the point where it can become more pronounced and potentially give rise to increased annoyance. This phenomenon is known as the 'Other' form of amplitude modulation of aerodynamic noise (OAM). There are currently no published limits of acceptability for OAM.

8.19 OAM only occurs at a small minority of wind farms for a minority of the time. As previously stated, with regard to NAM, ETSU-R-97 states that it takes "blade swish" into account in the noise limits it recommends. It is therefore proposed that further consideration of AM is excluded from the assessment.

Summary of Operational Noise Assessment Method

8.20 The operational noise assessment methodology in summarised in the IOA GPG as follows:

- "Predict noise levels from all turbines (existing and proposed) at the nearest receptors;
- Determine a study area;
- Identify potentially affected properties;
- (If required) Undertake a measurement survey consisting of simultaneous measurement of background noise levels at representative properties with wind speed and direction at the proposed turbine site;
- Analyse the data to remove rain affected and atypical data, and derive the noise limits for the scheme;
- Update noise predictions & assess compliance with the noise limits for a candidate turbine and provide design advice if compliance with the limits is considered unlikely."

8.21 For noise, an assessment of the Proposed Development will be based upon whether there is a direct impact. Since this effect is either present or absent it is not considered appropriate to define sensitivity or the magnitude of change in respect of these effects.

Proposed Construction Noise Assessment Methodology

8.22 The activities during construction, with the greatest potential to cause noise would occur during the early stages of the Proposed Development: primarily the laying of forest roads; and excavating and laying turbine foundations. The majority of the construction activities will be within the permitted hours of construction by ABC (08:00 to 19:00 Mondays to Fridays, 08:00 to 13:00 on Saturdays). Occasional work outside these hours may be required, in which case permission for short term extensions would be sought from ABC.

8.23 If works are anticipated to be required that may result in significant impacts (such as night-time works or access road construction which may be audible at NSRs) a detailed construction noise assessment will be undertaken using the data and procedures given in BS 5228 2009+A1:2014 'Code of practice for noise and vibration control from construction and open sites'.

8.24 With regard to decommissioning noise, related works are expected to be completed over a shorter period than construction and involving fewer road vehicles. No significant noise effects are expected during the decommissioning phase. Therefore, decommissioning noise assessment is scoped out of the EIA.

Proposed Traffic Noise Assessment Methodology

8.25 The construction of the wind farm may have a potentially significant impact on traffic flows on local roads around the site. Therefore, construction traffic noise impacts will be assessed. The operation of the wind farm will not generate significant levels of traffic, with only occasional and infrequent trips associate with maintenance or repair work, and as such it is proposed to exclude this from the assessment.

8.26 The change in road traffic noise levels during the construction phase, at a selection of relevant NSRs, will be predicted using the standard methodology outlined in the 'Calculation of Road Traffic Noise'. The predictions will be based on baseline and with development traffic data.

8.27 The significance of the impact on road traffic noise levels will be assessed based on a range of relevant guidance including the 'Design Manual for Roads and Bridges: 2011'.

Likely Significant Effects

Operational Noise

8.28 To give a preliminary indication of the potential operational noise effects of the Proposed Development, the maximum Development wind turbine noise levels have been predicted at each NSR. This also enables demonstration of whether the NSRs proposed for inclusion in the assessment and the baseline measurements are likely to be sufficient to capture the potential effects of the Proposed Development.

8.29 The selection of a turbine make and model for installation has not yet been made; however, a range of current turbines that fall within the Proposed Development envelope described in Chapter 3: Project Description, based upon their hub height and blade tip height constraints, are summarised in Table 8.4. Information supplied by the manufacturers has been used to determine the turbine sound power levels. These documents do not mention measurement uncertainty. Therefore a + 2 dB correction has been applied to the stated sound power levels to account for measurement uncertainty in line with the IOA GPG. The data presented are for turbine operations in a full unconstrained power mode.

Table 8.4: Potential Development Turbines and Maximum Sound Power Levels (wind speed of 8 m/s and above)

Turbine	Rated Power Output / MW	Maximum Sound Power Level (L_{WA} dB)	Uncertainty Correction (dB)	Sound Power Level Used in Model (L_{WA} dB)
Nordex N133/4.8	4.8	107.5	2.0	109.5
Siemens Gamesa SG 5.0-132	5.0	106.2	2.0	108.2

8.30 The predictions were based on the Nordex N133/4.8, as it has the greatest sound power level of those listed in Table 8.4, providing a reasonable worst-case assumption. Turbine hub heights have been modelled at 110m as this is the closest available hub height for which sound power level data are available to the maximum within the Proposed Development envelope (120m). The modelled turbine tip height is therefore 176m. At some receptors, the noise model indicates that some of the Proposed Development turbine tips will not be visible, in these situations 2 dB has been subtracted from the predicted turbine noise level. If the turbine tip is higher, more turbine tips may be visible, thereby increasing the predicted wind farm noise levels at an NSR by a maximum of 2 dB (if all tips go from invisible to visible).

8.31 The octave band sound power levels that have been used for each turbine are as shown in Table 8.5. For the purposes of the noise impact assessment these octave band noise levels have been normalised to each of the wind speed sound power levels so that predicted noise levels at each of the NSRs can be calculated. Turbine locations are presented in Table 8.6.

Table 8.5: Development Turbine Octave Band Sound Power Levels (L_{WA} dB)

Turbine Specification	Octave Band Centre Frequency (Hz)								
	31.5	63	125	250	500	1k	2k	4k	8k
Data from Manufacturer 8 m/s and above	79.4	89.0	94.8	98.0	100.4	102.3	101.4	96.0	82.2

Table 8.6: Development Turbine Locations

Turbine Number	Co-ordinates	
	X	Y
1	181221	682771
2	182158	682560
3	181388	682466
4	182619	682226
5	181646	682195
6	180900	682125
7	181126	681942
8	181741	681904
10	170883	641708
11	171384	641485
13	171994	641309
14	171172	641130

8.32 No allowance has been made for the character of the noise emitted by the wind turbines. In general, modern wind turbines are not tonal; however, an appropriate method to control such a characteristic is through the imposition of a planning condition which limits the level of tonality that a development may emit. ETSU-R-97 defines a method (ETSU-R-97, page 88) by which tonality may be assessed and, if required, an appropriate penalty to be assigned.

8.33 For the purpose of this initial assessment, the predictions have assumed NSRs are downwind of all turbines. At some NSRs this is an unrealistic over-estimate as they cannot be simultaneously downwind of all turbines (as this would require different wind directions at the same time).

Noise Model Assumptions

8.34 All noise level predictions have been undertaken using the following assumptions (in accordance with the IOA GPG):

- Ground Factor (ground absorption) (G) of 0.5 (i.e., mixed hard and soft ground) is used in conjunction with a measurement uncertainty for the candidate turbine;
- Each NSR has a height above ground of 4.0m (to represent a first-floor window);
- There are no screening effects from topography, vegetation, or intervening buildings and structures;
- An air absorption factor based on a temperature of 10°C and 70% relative humidity;
- Free-field conditions (i.e. no acoustic reflections from adjacent façades etc.); and
- When predicting noise levels at NSRs due to the operation of the Proposed Development it has been assumed that the hub height wind speed is the same at all of the installed turbines and, as such, each turbine emits the same sound power.

Results

8.35 Table 8.7 provides a summary of the predicted Proposed Development wind turbine $L_{A90,10min}$ noise levels at each of the NSRs at a wind speed of 8 m/s (the lowest wind speed at which the turbines are at their maximum sound power level). These are compared with the noise level limits for each of the NSRs which were agreed with ABC for inclusion within the 2016 planning consent for the Clachaig Glen development. It should be noted that the noise level limits may change after re-processing of the baseline noise level data and updated cumulative turbine noise level

calculations. Nevertheless, the Table gives an indication of whether the Proposed Development noise levels are likely to be similar to those which have previously been deemed acceptable. Due to the large distance between the Site and the nearest consented wind farms (Blary Hill and High Constellation) there are not anticipated to be any adverse cumulative noise impacts.

Table 8.7: Predicted Development Wind Turbine Noise Levels at NSRs

Description	NSR					
	The Braids	Beacharr	North Beachmore	North Crubasdale	High Clachaig	Low Clachaig
Predicted Development Noise Level	35.8	33.2	34.2	33.0	39.7	35.5
Daytime Noise Limit	40.8	45.2	46.8	43.2	43.5	43.5
Daytime Noise Limit met by*	**5.0**	**12.0**	**12.6**	**10.2**	**3.8**	**8.0**
Night Time Noise Limit	43	45.9	46.6	43.4	43.7	43.7
Night time Noise Limit met by*	**7.2**	**12.7**	**12.4**	**10.4**	**4.0**	**8.2**

* In these rows, a negative value indicates an exceedance of the limit, a positive value indicates compliance with the limit

8.36 Table 8.7 shows that the wind farm noise are expected to be below the consented noise limit at a wind speed of 8m/s. On this basis it is considered that operational noise effects are unlikely to be significant.

8.37 The predicted 35 dB L_{A90} contour for the Proposed Development turbine noise emissions is shown in Figure 8.2. This figure shows that the NSRs identified for inclusion within the assessment are sufficient to capture all potential locations where the wind turbine noise level may exceed this limit as a result of the Proposed Development.

Construction Noise

8.38 The 2016 EIA concluded that given the distances between the Proposed Development Site and the NSRs, and the type and duration of expected construction activities, it is unlikely that construction noise will result in significant adverse impacts. The Proposed Development construction duration and intensity will be similar to that considered in the 2016 EIA and therefore this conclusion is anticipated to still be applicable.

Construction Traffic Noise

8.39 Road traffic noise is considered unlikely to result in significant effects in light of the relatively infrequent number of abnormal load deliveries and the relatively small increase in light and heavy vehicles on the local road network.

Mitigation

Operational Noise

8.40 Subject to the conclusions of the operational noise assessment, operational noise impacts from wind farms can be mitigated via the imposition of constraints on power production under certain wind conditions. These can apply to all wind turbines or just those resulting in an exceedance of a limit at relevant NSRs. If power constraints are determined to be required, the resultant effect on power production will be identified, to inform the decision on appropriate daytime noise limits in accordance with ETSU-R-97 as described in para. 6.3.18.

Construction Noise

8.41 In order to mitigate noise impacts, and as part of industry good practice 'Best Practicable Means' will be adopted in order to mitigate against the construction noise and vibration impacts at any NSR. BS 5228 provides detailed advice on methods for minimising impacts from construction noise.

Construction Traffic Noise

8.42 Options available for mitigation of traffic noise are limited but may include the rerouting of the vehicles or the use of temporary noise barriers. It is unlikely that noise barriers would significantly mitigate the sound of the vehicles due to the access requirements for the properties. Depending on the conclusions of the assessment, alternative routes may be considered if they result in fewer affected receptors. It is not anticipated such measures will be required for the Proposed Development.

Summary and Conclusions

8.43 The EIA Report chapter will focus on operational noise at sensitive receiver locations resulting from the proposed wind turbines and will be undertaken in accordance with ETSU-R-97. To give a preliminary indication of the potential effects of the Proposed Development, the likely worst-case turbine noise levels at nearby NSRs have been predicted. These have been compared with the noise level limits included in the 2016 EIA for Clachaig Glen wind farm. The limits are not anticipated to be exceeded; therefore, operational noise effects are considered unlikely to be significant. It is noted that the 2016 EIA also concluded that potential noise impacts would be not significant.

8.44 Construction noise and road traffic noise impacts will also be considered; however, impacts are likely to be less significant than those from operational noise and is therefore expected to require a less detailed assessment. Best practicable means will be used to reduce construction noise impacts as far as possible.

References

Dick Bowdler, Andrew Bullmore, Bob Davis, Malcolm Hayes, Mark Jiggins, Geoff Leventhall, Andy Mackenzie (2009). Prediction and assessment of wind farm noise – Agreement about relevant factors for wind energy projects. Institute of Acoustics, Acoustics Bulletin March/April 2009, St Albans.

British Standard BS 5228-1:2009+A1:2014 Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise.

DTI (1996). ETSU R 97 'The Working Group on Noise from Wind Turbines: The Assessment and Rating of Noise from Wind farms. ETSU Report ETSU R 97.

International Standards Organisation (1996). ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation.

A. Moorhouse, M. Hayes, S. von Hünerbein, B. Piper, M. Adams, "Research into Aerodynamic Modulation of Wind Turbine Noise", URN 07/1235, University of Salford and Department for Business, Enterprise & Regulatory Reform, UK (2007)

A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, Institute of Acoustics, Issue 1, May 2013.

Highways Agency (2011) Design Manual for Roads and Bridges (DMRB) Volume 11 Part 7 HD213/11 Revision 1

The Scottish Government (2011). Planning Advice Note (PAN) 1/2011: Planning and Noise, March 2011.

Scottish Government (2011). Technical Advice Note: Assessment of Noise.

9. Ecology

Introduction

9.1 This Chapter addresses terrestrial and freshwater ecology. It does not include ornithology, which is the subject of Chapter 10 of this EIA Scoping Report. Throughout this Chapter the term 'ecological feature' is used to refer to sites designated for nature conservation, habitats, and species.

9.2 The approach to Scoping for ecology accords with the *Guidelines for Ecological Impact Assessment in the UK and Ireland*, published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018).

9.3 The scope of survey and assessment proposed has been informed by the results of detailed study completed for the 2016 EIA, carried out between 2014 – 2016. In addition, a desk study has been carried out in 2020 to review the results of ecology study completed to date and to update that information where relevant.

9.4 Throughout this chapter, the term 'Site' refers to the area within the site, including access tracks (see Figure 1.2).

Baseline Conditions

9.5 The baseline conditions with respect to ecology have been estimated through review of ecological study completed for the 2016 EIA and an updated desk study completed in 2020.

Summary of Ecological Survey Completed Between 2013 – 2016

9.6 As part of the EIA for the 2016 application, a desk study and a programme of ecological field survey was completed. A summary of the field survey carried out and the results obtained is presented below. Full details of the surveys referred to can be found in the *Clachaig Glen Environmental Statement Volume 2a: Main Text* and the associated figures in *Volume 2b* and in *Appendices 9.1 – 9.6* in *Volume 3* (2016 EIA).

9.7 Ecological field survey was carried out at the Site in 2013 and updated in 2015/16. The methods used on both occasions were broadly similar. A summary of the surveys completed is presented in Table 9.1, including reference to the relevant Appendices to the EIA where further details can be found. The survey areas adopted, as shown around the current proposed layout of the Proposed Development, are illustrated on Figures 9.1 and 9.2.

Table 9.1: Summary of Ecological Field Survey completed in 2013 and 2015/16

Ecological feature	Summary of survey	Relevant Appendix(ces) of EIA
Habitats	Phase 1 habitat survey within 250m of Proposed Development footprint and within 110m of main access track.	9.1 and 9.6
Vegetation	National Vegetation Classification (NVC) within 250m of Proposed Development footprint and within 110m of main access track. Compilation of a comprehensive plant species list.	9.1 and 9.6
Otter *Lutra lutra*	Survey of accessible watercourses and waterbodies to assess habitat suitability and record field signs. Survey area included all watercourses within the Site, plus all watercourse crossings along main access track up to 250m up- and downstream and all watercourses otherwise within 40m of the main access track.	9.2
Water vole *Arvicola amphibius*	Survey of accessible watercourses and waterbodies to assess habitat suitability and record field signs. Survey area included all watercourses within the Site, plus all watercourse crossings along main access track up to 250m up- and downstream and all watercourses otherwise within 40m of the main access track.	9.2
Badger *Meles meles*	Survey for field signs, focussing on accessible and suitable habitats likely to be affected by the Proposed Development. Survey area covered the Site plus a 30m buffer around the main access track.	9.2
Pine marten *Martes martes*	Survey to assess habitat suitability and record field signs. Survey area covered the Site plus a 30m buffer around the main access track.	9.2
Red squirrel *Sciurus vulgaris*	Survey to assess habitat suitability and record field signs.	9.2
Wildcat *Felis silvestris*	Survey to assess habitat suitability and record field signs. Survey area covered the Site plus a 30m buffer around the main access track.	9.2
Reptiles, amphibians and arthropods	Anecdotal observations of reptiles, amphibians and arthropods within the Site.	9.2
Fish	Habitat assessment of watercourses followed by targeted electrofishing of suitable watercourses within the Site.	9.3
Freshwater pearl mussel *Margaritifera margaritifera*	Habitat assessment of watercourses and observation within the Site.	9.3
Bats	Suite of surveys comprising walked transect surveys to record bat activity, driven transect surveys, and static detector monitoring within the Site.	9.4

9.8 The Phase 1 habitat and NVC surveys identified a range of broad habitat types. The most extensive were conifer plantation, wet heath, blanket bog and marshy grassland, with smaller areas of other habitats including bracken *Pteridium aquilinum*, acid/neutral flush, improved grassland, neutral grassland and acid grassland, and semi-natural woodland along parts of the lower access track.

9.9 The following habitats listed on Annex I of the Habitats Directive[8] were identified:

- northern Atlantic wet heaths with Erica tetralix (comprising areas of wet dwarf shrub heath, locally extensive in open upland parts of the Site and along some forestry rides, of NVC community M15);
- European dry heaths (comprising localised smaller areas of dry dwarf shrub heath of NVC communities H10, H12 and, very locally, H21); and,
- blanket bog (comprising areas of bog, extensive in the open upland parts of the Site, supporting the NVC communities M19, M17 and M18 in decreasing order of abundance).

9.10 In addition, the following habitats listed on the Scottish Biodiversity List (SBL) and which are therefore of principal importance for biodiversity conservation in Scotland were also present:

- wet woodland;
- upland heathland;
- purple moor-grass and rush pasture;
- upland flushes, fens and swamps;
- blanket bog;
- rivers; and,
- oligotrophic and dystrophic lakes.

9.11 The results of the other ecological surveys are summarised in Table 9.2, below.

Table 9.2: Summary of Baseline Conditions as reported in 2016 EIA

Ecological Feature	Survey results
Otter	Evidence of otter was recorded along the Killean Burn (associated with the main access track) including two potential holts and multiple spraints and feeding remains. No evidence of otter was recorded within the main turbine area (i.e. away from the Killean Burn) or within 200m of the main turbine footprint, although evidence outside the survey area included an otter heard entering a watercourse to the north, and a lay-up to the west.
Water vole	No sightings or evidence recorded in 2013. Multiple signs including feeding remains, a latrine and potential burrows were recorded along a short stretch of the main course of the Clachaig Water in 2015. Habitat suitability generally unfavourable in other areas. Records were more than 250m from the only upstream watercourse crossing.
Badger	No evidence recorded. It is likely that badger is distributed in low density in the local area but is absent from the survey area.
Pine marten	A single scat recorded in 2013 but no sightings or evidence recorded in 2015.
Red squirrel	No sightings or evidence recorded in 2013 or 2015/16.
Wildcat	No sightings or evidence recorded in 2013 or 2015/16.
Reptiles	Common lizard Zootoca vivipara and adder Vipera berus recorded occasionally in 2013 and 2015/16.
Amphibians	No observations or evidence recorded in 2013. Common frog Rana temporaria and common toad Bufo bufo recorded occasionally in 2015/16.
Arthropods	Some pockets of habitat of particular value for arthropods identified, but these are all of ecological value in their own right, thus arthropods are likely to be safeguarded indirectly.

[8] Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, which is more commonly referred to as the 'Habitats Directive'.

Ecological Feature	Survey results
Brown trout	Landlocked brown trout Salmo trutta fry and parr were recorded infrequently in the main river channels of Clachaig Water and Allt Achahd a' Choirce but were not recorded in tributary streams. The density of brown trout was relatively low compared to the wider region, although typical of such landlocked populations in forestry. No adult brown trout were recorded.
Other fish	No other notable fish species (such as Atlantic salmon Salmo salar, lamprey species or European eel Anguilla anguilla) were recorded. Obstacles to migration prevent these migratory fish establishing within the Site.
Freshwater pearl mussel	No evidence recorded and habitats unsuitable for this species.
Bats: pipistrelle species (common pipistrelle Pipistrellus pipistrellus, soprano pipistrelle Pipistrellus pygmaeus and Pipistrellus sp.)	Roost suitability assessment – no roosts or potential roosts confirmed. Coniferous woodland offers negligible roosting habitat. Transect surveys – sparsely distributed, low level of activity recorded. Static detector monitoring – low levels of activity and no apparent spatial or temporal pattern.
Bats: brown long-eared Plecotus auritus	Roost suitability assessment – no roosts or potential roosts confirmed. Coniferous woodland offers negligible roosting habitat. Transect surveys – no activity recorded. Static detector monitoring - activity recorded at extremely low levels, with a very restricted distribution in the survey area.
Bats: Myotis species	Roost suitability assessment – no roosts or potential roosts confirmed. Coniferous woodland offers negligible roosting habitat. Transect surveys – no activity recorded. Static detector monitoring – low level of activity in the Ecology Survey Area. No apparent spatial or temporal pattern.
Bats: other species (unidentified or indeterminate bat species)	Roost Assessment: No roosts or potential roosts confirmed. Coniferous woodland offers negligible roosting habitat. Transect Surveys: Sparsely distributed low level of activity recorded. Remote monitoring: Low intensity of activity and no apparent spatial or temporal pattern.

Desk Study Information

9.12 A desk study was carried out to inform the 2016 EIA. This was updated in 2020 to review the findings of that desk study and to add to it, where necessary.

9.13 The 2020 desk study sought to identify nature conservation designations and records of protected and notable habitats and species potentially relevant to the Proposed Development. A stratified approach was taken when defining the desk study area, based on the likely zone of influence of the Proposed Development on different ecological features. Accordingly, the desk study searched for:

- any international nature conservation designations within 10 km of the Site;
- other statutory nature conservations designations within 2 km of the Site;
- records of protected and notable habitats and species within 2 km of the Site; and,
- local non-statutory nature conservation designations within 1 km of the Site.

9.14 A range of data sources were used for the desk study, as set out in Table 9.3. The Highland Biological Recording Group (HBRG) were contacted as they currently hold all records for the Argyll and Bute region, however they were unable to provide any recent records due to technical difficulties. HBRG confirmed to AECOM that all of the records that they currently hold are available from National Biodiversity Network (NBN) Atlas Scotland. As such, all relevant and commercially available records made since the year 2000 were extracted from NBN Atlas Scotland.

Table 9.3: Desk Study Data Sources

Data source	Date accessed	Data obtained
Argyll and Bute Council website	26/05/2020	• Local Development Plan policies relevant to nature conservation. • Local non-statutory nature conservation designations within 1 km of the Site. • Local Biodiversity Action Plan information.
NBN Atlas Scotland (commercially-available records only)	27/05/2020	• Recent biological records, defined as being from the year 2000 onwards (inclusive).
Ordnance Survey (OS) 1:25,000 maps and aerial photography	26/05/2020	• Habitats and connectivity relevant to interpretation of planning policy and potential protected / notable species constraints.
SEPA River Basin Management Plan (RBMP)	15/04/2020	• Status of waterbodies / watercourses.
SNH Natural Spaces webpage (https://gateway.snh.gov.uk/natural-spaces/)	26/05/2020	• Ancient Woodland Inventory (AWI) for Scotland. • Results of Native Woodland Survey of Scotland (NWSS).
SNH SiteLink webpage (https://sitelink.nature.scot/home)	26/05/2020	• International statutory designations within 10 km. • Other statutory designations within 2 km.

Statutory Designations

9.15 Two statutory designated sites for nature conservation relevant to ecology (and not including ornithology, for which see Chapter 10) were identified by the desk study.

9.16 Rhunahaorine Point Site of Special Scientific Interest (SSSI) is located just beyond the search distance specified above for nationally designated sites, approximately 2.2 km north of the main access track and approximately 4 km from the main part of the Proposed Development. The foreland at Rhunahaorine Point consists of shingle rides and the vegetation is a mosaic of habitats including dry heath, wetland and vegetated shingle.

9.17 The Inner Hebrides and the Minches Special Area of Conservation (SAC) is a marine site for the which the sole qualifying feature is harbour porpoise *Phocoena phocoena*. The closest point of the SAC is approximately 6.5 km north of the main access track and 8.25 km from the main Development. There is hydrological connectivity between the Development and the site via the Clachaig Water and Killean Burn.

Non-statutory Designations

9.18 No local sites designated for nature conservation exist within the search distances specified above.

9.19 Two areas of woodland present on the Ancient Woodland Inventory are located within 1 km of the Site. These are both situated to the north of the western extent of the main access track. The closest area is approximately 345m from the track (see Figure 9.2). From aerial photography these appear to comprise a strip of broadleaved woodland adjacent to the A83 and a larger area of mixed woodland adjacent to nearby conifer plantation. The location of native and nearly-native woodland is shown on Figure 9.2.

9.20 Several areas listed as 'native' or 'nearly native' on the Native Woodland Survey of Scotland are located within 1 km of the Site. A long, broken corridor of native woodland to the south-west is partially within the Site and continues down the length of Clachaig Glen. Other areas of native or nearly-native woodland are more distant, with the closest being approximately 400m from the Site.

Records of Protected and Notable Species

9.21 Two commercially-available records of otter were present on NBN Atlas Scotland. These were both from the coast, one from the vicinity of Tayinloan Ferry Terminal (2016), and the second likely from Allt an Fheuraich, near to A'Cheit Church (2018). Both records were provided by Argyll Biological Records Centre.

9.22 A single commercially-available 1985 record of wildcat, provided by the Argyll Biological Records Centre and accessed via NBN Atlas Scotland, was returned from the 10 km grid square in which the Site is located. No more recent records were available.

9.23 Commercially-available records of two insect species present on the SBL were returned from the surrounding area, all of which were provided by Argyll Biological Records Centre. These were small pearl-bordered fritillary *Boloria selene* (most recent 2015) and cinnabar moth *Tyria jacobaeae* (2019).

9.24 Commercially-available records of nine notable lichen species were provided by British Lichen Society and accessed through NBN Atlas Scotland website. These included one nationally rare species (Occurring in fifteen or fewer hectads in Great Britain), *Endococcus verrucisporus*, and one nationally scarce species (Occurring in 16-100 hectads in Great Britain) *Stereocaulon delisei*. Both of these species are listed on the Scottish Biodiversity List, as are the additional seven species which were recorded: *Hypotrachyna sinuosa*, *Leptogium cyanescens*, *Lobaria pulmonaria*, *Pannaria rubiginosa*, *Pseudocyphellaria crocata*, *Sticta limbata* and *Sticta sylvatica*. All records were from 2015 and from the woodland on the Clachaig Water between the Site and Muasdale.

9.25 No records of water vole, badger, pine marten, red squirrel or bats were identified during the desk study.

Methods

Field Survey

9.26 A substantial amount of ecological study, including desk-based research and targeted field survey, has been completed at the Site since 2013. As described in more detail in Chapter 3, the layout of the Proposed Development has not changed from that which has already been consented and which was the subject of ecological study in 2013 and 2015/16 (other than that two wind turbines have been removed). The survey areas used previously are therefore still relevant to the Proposed Development as it is currently proposed.

9.27 Due to the availability of detailed survey information covering the area relevant to the Proposed Development, the scope of ecological field survey for 2020 will therefore seek to simply update the work already completed in 2013 and 2015/16. The following field survey will be carried out:

- Phase 1 habitat survey and NVC – this will be carried out within a minimum of 250m of Proposed Development infrastructure (but not including the main access track, which already exists as a substantial forestry road). The aim of these surveys will be to confirm that the habitats / vegetation communities remain as reported in the 2016 EIA and that there have been no substantial changes in the intervening period. It will not be a full re-survey according to the standard methodologies for Phase 1 habitat survey and NVC survey;
    - protected mammal survey – this will include searches for otter, water vole, badger and pine marten. Survey for these species will be carried out in areas of suitable habitat within a maximum distance of 200m from Proposed Development infrastructure; and,

- bat activity survey – this will replicate the surveys carried out in 2015/16 and will involve a walked transect, to be completed on three occasions between May and August, inclusive (note that in 2015 a driven transect was also carried out, but due to Covid-19 restrictions, this will not be possible in 2020 as two surveyors cannot be in the same vehicle). An assessment of the bat roost suitability of all trees and structures within 100m of Proposed Development infrastructure will also be carried out.

- Based on the expected baseline conditions, as informed through review of the results of field survey in 2013 and 2015/16, and on the results of the 2020 desk study, the following surveys are proposed to be excluded:
  - no survey for red squirrel will be carried out as it can reliably be assumed that this species continues to be present at low densities within the conifer plantation woodland present at the Site. The conifer plantation is of Sitka spruce Picea sitchensis which is well-known to support only lower numbers of red squirrel, with published guidance on typical densities. Standard mitigation, namely pre-felling checks for dreys, can be recommended to minimise impacts on this species;
  - no further survey for freshwater pearl mussel will be carried out. Field survey in 2015/16 found no suitable habitat for this species and this is extremely unlikely to have changed in the intervening period; and,
  - no further survey for fish is proposed. Although relict brown trout were found in some watercourses in the vicinity of the Site, natural barriers downstream prevent the movement of notable species to the area around the Proposed Development.

9.28 It should be also noted that in 2019, Scottish Natural Heritage (SNH) adopted new guidelines for survey and assessment of bats and onshore wind turbines (Scottish Natural Heritage *et al*, 2019). These guidelines recommend that static bat detectors are deployed at each individual proposed turbine location for developments comprising ten turbines or fewer, or at ten turbines plus a third of additional turbines for developments comprising more than ten turbines. A total of fifteen static detectors were deployed for a period of five nights during the periods of June-July, August and September 2015. They recorded very low levels of bat activity on Site, with a total of 220 bat passes over the course of 1,987.5 hours of survey time. The species recorded were common pipistrelle, soprano pipistrelle, brown long-eared bat and an unidentified myotis species.

9.29 Due to the very low levels of bat activity recorded in 2015, it is considered unnecessary to strictly follow the recent 2019 guidelines adopted by SNH. Instead, up to ten static detectors will be placed at or close to the majority of proposed turbine locations. Where turbine locations are in dense commercial forestry, the detectors will be placed in the nearest potentially suitable bat habitat, for example adjacent to open rides or watercourses which could be used by foraging and/or commuting bats. These detectors are currently being deployed for a minimum period of ten nights on three occasions between May and August 2020, inclusive.

Impact assessment

9.30 The results of the completed field surveys, in combination with the outcomes of desk study and any consultation with relevant stakeholders, will be used to inform the Ecological Impact Assessment (EcIA) component of the EIA. This will be conducted in accordance with the industry-standard guidelines produced by CIEEM (CIEEM, 2018). Where significant effects on an ecological feature are predicted by the EcIA, appropriate mitigation measures will be proposed. Likely mitigation measures are outlined in the mitigation section outlined below. Ecological enhancement measures that are proportionate to the impact of the Proposed Development will also be considered in pursuance of the objective of Scottish Planning Policy to achieve net biodiversity gains from development.

Potential Significant Effects

9.31 The potential significant effects of the Proposed Development on ecological features can be categorised as follows:

- permanent habitat loss (e.g. the loss of notable habitats due to construction of access tracks or other infrastructure);

- temporary habitat loss (e.g. the temporary loss of habitat to accommodate temporary construction compounds or other works areas);
- habitat degradation as a result of pollution incidents (e.g. fuel or oil spills) during construction or operation;
- permanent or temporary changes to hydrological conditions which may affect vegetation and habitats (e.g. where tracks intercept flushes or infrastructure impacts upon a groundwater dependent terrestrial ecosystem);
- loss of habitat which supports protected and/or notable species (e.g. the loss of habitat which supports reptiles);
- creation of barriers to animal movements (e.g. the construction of watercourse crossings could prevent the movement of otter, water vole and/or resident fish);
- temporary disturbance and/or displacement of species during construction (e.g. disturbance of protected species whilst occupying places of shelter);
- disturbance and/or displacement of species during operation (e.g. the use of permanent lighting could impact upon bat foraging);
- potential for direct mortality of species during construction (e.g. as a result of increased vehicular traffic, or as a result of pollution incident); and,
- potential for direct mortality of bats during operation due to collision with operational wind turbines or as a result of barotrauma caused when bats fly in close proximity to operational wind turbines.

9.32 The potential significant effects on ecological features outlined above will be assessed by the EIA.

9.33 A single SAC exists within 10 km of the Proposed Development: the Inner Hebrides and the Minches SAC. This is designated for harbour porpoise. As there is a hydrological connection with the marine environment, which could be used by porpoises belonging to the SAC, the potential for effects on this European site will be considered as part of a Habitats Regulations Appraisal (HRA) screening exercise, to be reported in an HRA Screening Report. As it is not anticipated that any likely significant effects on the Inner Hebrides and the Minches SAC will be identified, it is not currently proposed that the next stage of HRA (Appropriate Assessment) will be required.

Mitigation Measures

9.34 Compliance with planning policy requires that the Proposed Development considers and engages the following mitigation hierarchy where there is potential for impacts on relevant ecological features:

1. avoid features where possible;
2. minimise impact by design, method of working or other measures (mitigation), for example by enhancing existing features; and,
3. compensate for significant residual impacts (e.g. by providing suitable habitats elsewhere).

9.35 This hierarchy requires the highest level to be applied where possible. Only where this cannot reasonably be adopted should lower levels be considered.

9.36 At this stage in the design of the Proposed Development, it is not possible to make detailed recommendations for mitigation. The requirement for specific mitigation will be determined based on the results of desk study and field survey work and the subsequent EIA.

9.37 However, it is likely that the following generic mitigation measures will be required to reduce the impacts of the Proposed Development:

- minimising the loss of habitats of high conservation value through project design and micro-siting;

- providing compensatory habitat, where appropriate, for permanent losses to the Proposed Development (e.g. replanting of a larger area of native broadleaved trees than is felled to accommodate construction works);
- restoring areas of habitat temporarily lost during the construction period;
- implementing standard pollution prevention measures to protect surface water systems, groundwater and species;
- maintaining the existing hydrological regime, particularly in blanket bog and groundwater dependent terrestrial ecosystems;
- designing watercourse crossings to be passable to fish, otter and water vole;
- avoiding key areas and/or features used by protected and/or notable species through project design and micro-siting;
- timing of construction activities to minimise impacts upon species;
- pre-construction and pre-felling checks for protected species;
- implementing works exclusion zones around specially protected species to ensure that they are not disturbed or otherwise directly harmed during construction, and acquiring associated licensing where necessary to ensure legal compliance; and,
- appointment of an Ecological Clerk of Works (ECoW) for the duration of the construction period.

9.38 Note that the measures described above, in addition to those which are designed as part of the EIA process, will be incorporated into a Habitat Management Plan (HMP). In addition, a Construction Environment Management Plan (CEMP) will be prepared detailing pollution prevention measures to be implemented during the construction phase of the Proposed Development.

Summary and Conclusions

9.39 It is possible that there may be permanent and temporary adverse effects on ecological features as a result of the Proposed Development.

9.40 Detailed ecological study, including desk-based research and targeted field survey, was completed at the Site in 2013 and in 2015/16. This work covered the area relevant to the layout of the Proposed Development as currently proposed, as there has been no change since the 2016 planning application (other than the removal of two turbines). The proposed scope of survey therefore seeks to update the work completed previously and will include:

- update to Phase 1 habitat and NVC survey to confirm no changes to habitats or vegetation communities since 2016;
- survey for otter, water vole, badger and pine marten;
- bat activity survey via three walked and three driven transect surveys to be completed between May and August 2020, inclusive;
- deployment of ten static bat detectors for a minimum of ten consecutive nights during three periods between May and August 2020, inclusive; and,
- bat roost suitability assessment of trees and structures within 100m of Development infrastructure.

9.41 The potential effects of the Proposed Development will be assessed, using the baseline information collected between 2013 – 2016 and updated in 2020, following the methods for Ecological Impact Assessment described by CIEEM.

9.42 Appropriate mitigation will be developed and implemented to minimise the impacts of the Proposed Development. Where significant effects cannot be avoided, proportionate compensatory measures will be provided. Where possible, ecological enhancement will also be suggested and incorporated into the Proposed Development.

References

CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Version 1.1 – updated September 2019. Chartered Institute of Ecology and Environmental Management, Winchester.

E.ON/AECOM (2016a). Clachaig Glen Wind Farm Environmental Statement, Volume 2a Main Text.

E.ON/AECOM (2016b). Clachaig Glen Wind Farm Environmental Statement, Volume 2b Figures.

E.ON/AECOM (2016c). Clachaig Glen Wind Farm Environmental Statement, Volume 3 Appendices. Appendices 9.1 – 9.6.

Scottish Natural Heritage, Natural England, Natural Resources Wales, RenewableUK, ScottishPower Renewables, Ecotricity Ltd., University of Exeter and Bat Conservation Trust (2019). Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation. Version: January 2019.

10. Ornithology

Introduction

10.1 This chapter addresses ornithology. It considers birds only and not wider terrestrial ecology, which is the subject of Chapter 9 of this EIA Scoping Report. Throughout this Chapter the term 'ornithological feature' is used to refer to sites designated for the conservation of birds, and to bird species and the habitats which support them.

10.2 The approach to Scoping for ornithology accords with the *Guidelines for Ecological Impact Assessment in the UK and Ireland*, published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018). It is also based on the *Recommended bird survey methods to inform impact assessment of onshore wind farms*, published by Scottish Natural Heritage (SNH, 2017).

10.3 The scope of survey and assessment proposed has been informed by the results of detailed study completed for the 2016 EIA, carried out between 2014 – 2016, and on further ornithology survey carried out for the revised proposal in 2018 and 2019. In addition, a desk study has been carried out in 2020 to review the results of ornithology study completed to date and to update that information where relevant.

10.4 Throughout this chapter, the term the 'Site' is used to referred to the area within the red line boundary of the Proposed Development.

10.5 It should be noted that SNH has already been consulted in 2020 on the scope of ornithology assessment. AECOM provided an overview of the ornithological field survey completed to date and SNH responded, advising via email that:

- the revised application for the Proposed Development will need to include a full assessment of all key species and include revised collision risk modelling based on the new layout (see Chapter 3 for a detailed description of how the Proposed Development compares with the currently consented design) and increased size of turbines;
- one of the main ornithological sensitivities for the Site is golden eagle;
- if the planning application for the Proposed Development is not submitted until 2021, SNH considers that the 2015 breeding bird data would be too dated. As a result, they would therefore recommend that a further breeding season worth of survey should be carried out in 2020.

Baseline Conditions

10.6 The baseline conditions with respect to ornithology have been determined through:

- review of the results of desk study and field survey carried out between 2014 – 2016 for the 2016 EIA;
- review of the results of field survey carried out in 2018 and 2019 for the Proposed Development; and,
- an updated desk study completed in 2020.

10.7 All ornithology survey conducted at Clachaig Glen since 2014 has been completed following the guidelines in SNH (2017) and the species-specific methodologies listed below (or earlier versions of these documents, according to the time that survey was carried out):

- the Brown and Shepherd (1993) methodology for censusing upland waders – in line with recommendations made by Calladine et al (2009), four visits are made during the breeding season to survey for breeding waders and other upland breeding passerines;
- species-specific approaches for surveying raptors described in Hardey et al (2013); and,
- other species-specific methodologies described in Gilbert et al (1998), including for breeding divers and lekking black grouse Tetrao tetrix.

10.8 A description of the level of survey effort completed at various times since 2014 is provided under the following sub-headings. Full details of the surveys carried out between 2014 – 2016 for the original EIA, which are summarised below, can be found in the *Clachaig Glen Environmental Statement Volume 2a: Main Text* and the associated figures in *Volume 2b* and in *Appendix 10.1* in *Volume 3* and the *Confidential Annex* in *Volume 4* (2016 EIA).

10.9 Full details of the surveys carried out between 2018 – 2019 for the Proposed Development as currently proposed can be found in Fielding (2019).

10.10 Table 10.1 at the end of this section provides an overview of the level of ornithological survey completed at Clachaig Glen to date.

Ornithology Survey Completed Between 2014 – 2016

10.11 Survey carried out for the 2016 EIA for Clachaig Glen Wind Farm was conducted between November 2014 and April 2016, inclusive. Surveys carried out during that period included:

- vantage point (VP) survey from three locations between November 2014 – April 2016, inclusive. Approximately nine hours of survey from each VP location were completed per month during this time, resulting in a total of 485 hours of observation;
- moorland breeding bird surveys between April – July 2014 and April – July 2015. The survey area for moorland breeding birds extended to approximately 2 km from the main Site and to 500m either side of the main access track;
- breeding raptor surveys between March – August 2014 and March – August 2015. Survey was carried out within 2 km of the Site;
- survey for breeding red-throated diver Gavia stellata and black-throated diver Gavia arctica between April – August 2014 and April – August 2015, within 2 km of the Site; and,
- lekking black grouse survey in April and May 2014, and April and May 2015. Survey was completed within at least 1.5 km of all proposed turbine locations and associated infrastructure, with all suitable areas for lekking visited on at least two occasions in 2014 and in 2015.

Ornithology Survey Completed Between 2018 – 2019

10.12 Field survey for the Proposed Development as it is currently proposed was carried out between April 2018 and February 2019. As the turbine locations associated with the revised Proposed Development layout are in the same position as those in the currently consented design, the field survey areas adopted in 2018/19 covered the same area as those for the 2016 EIA between 2014 – 2016. As highlighted above, the surveys followed the same guidelines and implemented the same methods as used between 2014 – 2016.

10.13 The following surveys were completed between April 2018 – February 2019:

- between April – July 2018, six hours of vantage point survey was carried out per month from the locations of VP1 and VP3 used for the 2016 EIA. From August 2018, a third vantage point location was added (named as VP2 but in a different location to the VP2 used for the 2016 EIA). Between August 2018 and February 2019, at least nine hours of survey were completed from each of the three VP locations. In total, 271 hours of survey were completed;
- survey for breeding raptors, including golden eagle, and divers was carried out over three days between 24 – 26 July 2018:
  - survey for breeding golden eagle extended to approximately 6 km from the Proposed Development;
  - survey for other breeding raptors extended to approximately 2 km from the Proposed Development; and,
  - survey for breeding divers extended to approximately 2 km from the Proposed Development.

10.14 No survey for moorland breeding birds or for lekking black grouse was carried out in the 2018 breeding season.

Overview of Survey Completed to Date

10.15 An overview of all of the ornithological field survey completed at Clachaig Glen since 2014 is provided in Table 10.1, below. The oldest data available were collected in 2014 and these are now just over five years old. The remaining data were collected from 2015 onwards and are therefore approximately five years old or less.

Vantage point surveys

10.16 VP surveys have covered two full non-breeding seasons – 2015/16 and 2018/19 – plus the majority of the 2014/15 non-breeding season (November 2014 – February 2015). VP survey covered the full 2015 breeding season plus all but one month (March) of the 2018 breeding season.

10.17 This means that, with the exception of one month at the very beginning of the 2018 breeding season, VP surveys have been completed over two non-breeding and two breeding seasons in the last five years since 2015.

Breeding raptor and diver surveys

10.18 A full programme of breeding raptor and diver surveys was completed in each of 2014 and 2015. Those carried out in 2014 are now more than five years old. However, an update to these surveys was carried out in 2018. Although comprising only a single visit, the results of vantage point survey carried out throughout the 2018 breeding season provide complementary data on the presence (or likely absence) of breeding raptor and diver species.

Lekking black grouse surveys

10.19 Lekking black grouse surveys were carried out in 2014 and in 2015. Those carried out in 2014 are now more than five years old, however those completed in 2015 are approximately five years old. No update of these surveys was carried out in 2018.

Table 10.1 Overview of ornithological field survey completed to date at Clachaig Glen

Year	Survey	Survey period	Description of survey effort
2014	Breeding raptors	March – August 2014	Covering the entire 2014 breeding season.
	Lekking black grouse	April and May 2014	Covering the peak lekking season in 2014.
	Moorland breeding birds	April – July 2014	Four survey visits covering 2014 breeding season.
	Breeding divers	April – August 2014	Covering the entire 2014 breeding season.
	VPs	November – December 2014	Together with VP survey completed in January and February 2015, this covers the majority of the 2014/15 non-breeding season.
2015	VPs	January – February 2015	Together with VP survey completed in November and December 2014, this covers the majority of the 2014/15 non-breeding season.
		March – August 2015	Full six months of survey covering the 2015 breeding season.
	Breeding raptors	March – August 2015	Covering the entire 2015 breeding season.

	Lekking black grouse	April and May 2015	Covering the peak lekking season in 2015.
	Moorland breeding birds	April – July 2015	Four survey visits covering 2015 breeding season.
	Breeding divers	April – August 2015	Covering the entire 2015 breeding season.
	VPs	September – December 2015	Together with VP survey in January and February 2016, this covers the entire 2015/16 non-breeding season.
2016	VPs	January – February 2016	Together with VP survey between September – December 2015, this covers the entire 2015/16 non-breeding season.
		March – April 2016	Covering early part of 2016 breeding season.
2018	VPs	April – August 2018	Covering the majority of the 2018 breeding season.
	Breeding raptors	July 2018	Single breeding season survey visit.
	Breeding Divers	July 2018	Single breeding season survey visit
	VPs	September – December 2018	Together with VP survey between January – February 2019, this covers the entire 2018/19 non-breeding season.
2019	VPs	January – February 2019	Together with VP survey between September – December 2018, this covers the entire 2018/19 non-breeding season.

Summary of Results of Ornithology Survey Completed to Date

10.20 In the interests of confidentiality, no specific details are provided in this EIA Scoping Report on the possible locations of raptor nest sites. A list of the key species which have been recorded at the Site and which will require assessment as part of the EIA are listed below. Further details on the results of ornithology survey completed to date can be found in the 2016 EIA and associated documents, including the *Confidential Annex* in *Volume 4*, and in Fielding (2019).

10.21 The key species recorded are:

- Greenland white-fronted goose Anser albifrons flavirostris;
- golden eagle;
- hen harrier Circus cyaneus;
- red-throated diver;
- black grouse; and
- breeding moorland waders, including golden plover Pluvialis apricaria and curlew Numenius arquata.

10.22 Other protected or otherwise notable bird species of conservation concern have been recorded to date, but their occurrence on Site has been rare. They are therefore unlikely to be significantly affected by the Development.

Desk Study Information

10.23 A desk study was carried out to inform the EIA for the 2016 Clachaig Glen Wind Farm application. This was updated in 2020 to review the findings of that desk study and to add to it, where necessary.

10.24 The 2020 desk study sought to identify nature conservation designations and records of bird species potentially relevant to the Proposed Development. A stratified approach was taken when defining the desk study area, based on the likely zone of influence of the Proposed Development on different ornithological features. Accordingly, the desk study searched for:

- any international nature conservation designations within 10 km of the Site;
- other statutory nature conservations designations within 2 km of the Site;
- records of bird species within 2 km of the Site; and,
- local non-statutory nature conservation designations within 1 km of the Site.

10.25 A range of data sources were used for the desk study, as set out in Table 10.2. The Highland Biological Recording Group (HBRG) were contacted as they currently hold all records for the Argyll and Bute region, however they were unable to provide any recent records due to technical difficulties. HBRG confirmed to AECOM that all of the records that it currently holds are available from NBN Atlas Scotland. As such, all relevant and commercially-available records made since the year 2000 were extracted from NBN Atlas Scotland.

Table 10.2 Desk study data sources

Data source	Date accessed	Data obtained
Argyll and Bute Council website	26/05/2020	• Local Development Plan policies relevant to nature conservation. • Local non-statutory nature conservation designations within 1 km of the Site. • Local Biodiversity Action Plan information.
NBN Atlas Scotland (commercially-available records only)	27/05/2020	• Recent records of bird species, defined as being from the year 2000 onwards (inclusive).
Ordnance Survey (OS) 1:25,000 maps and aerial photography	26/05/2020	• Habitats and connectivity relevant to interpretation of planning policy and potential constraints associated with bird species.
SNH SiteLink webpage (https://sitelink.nature.scot/home)	26/05/2020	• International statutory designations within 10 km. • Other statutory designations within 2 km.

10.26 The Argyll Raptor Study Group will be contacted for relevant information pertaining to the Site. However, given the level of field survey carried out since 2014, it is unlikely that they will provide any new records that have not already been identified by surveys conducted for the Proposed Development.

Statutory Designations

10.27 Four statutory designated sites for the conservation of bird species exist within the search distances specified above (Rhunahaorine Point Site of Special Scientific Interest (SSSI) is included as it is located just beyond the 2 km search distance for nationally designated sites). These are described below in Table 10.3. Their locations in relation to the Proposed Development are presented in Figure 10.1.

Table 10.3 Statutory Designated Sites relevant to Ornithology

Designation	Reason(s) for designation	Relationship to the Site
Sound of Gigha Proposed Special Protection Area (pSPA)	At consultation stage. A large site providing diverse marine habitats for a range of sea birds. The proposed designated features are: • eider *Somateria mollissima*, non-breeding; • great northern diver *Gavia immer*, non-breeding; • red-breasted merganser *Mergus serrator*, non-breeding; and, • Slavonian grebe *Podiceps auritus*, non-breeding.	Located 645m west of the access track entrance and 1.25 km west of the Proposed Development and separated by farmland. There is a hydrological connection between the Proposed Development and the pSPA via the Clachaig Water and Killean Burn.
Rhunahaorine Point Site of Special Scientific Interest (SSSI)	The site is important as a roosting and feeding area for large numbers of wintering Greenland white-fronted geese and for supporting the largest little tern *Sternula albifrons* colony on Kintyre. The notified ornithological features are: • Greenland white-fronted goose, non-breeding; and, • Little tern, breeding.	Located 2.17 km north of the access track and 4 km north of the main Development and separated by farmland and conifer plantation.
Kintyre Goose Roosts Special Protection Area (SPA) and Wetland of International Importance (Ramsar site)	The Kintyre Goose Roosts SPA and Ramsar site comprises a series of hill lochs (Loch Garasdale, Loch an Fhraoich, Loch Lussa, Tangy Loch and Black Loch) and an area of grassland and heath at Rhunahaorine Point. The site regularly supports an internationally important wintering population of Greenland white-fronted goose, which is the sole qualifying feature.	A multi-part site located 2.41 km north of the access track and 3.1 km north of the main Development at its nearest point and separated by farmland and conifer plantation. All but one area (located at Refleuch) of the Kintyre Goose Roosts SPA are coincident with the Ramsar site.
Kintyre Goose Lochs SSSI	The Kintyre Goose Lochs SSSI comprises a series of hill lochs (Loch Garasdale, Loch an Fhraoich, Loch Lussa and Black Loch). These sites are notified for their aggregations of Greenland white-fronted geese with each roost supporting nationally or internationally-important numbers over the winter months.	A multi-part Site located 2.41 km north of the access track and 3.1 km north of the main Development at its nearest point and separated by farmland and conifer plantation. Partly coincident with the Kintyre Goose Roosts SPA but wholly coincident with the Kintyre Goose Roosts Ramsar site boundary.

Non-Statutory Designations

10.28 No local sites designated for conservation of bird species exist within the search distances specified above.

Records of Bird Species

10.29 Numerous records of bird species, all of which were provided by RSPB and were commercially-available, were available from NBN Atlas Scotland.

10.30 This included three species on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) (the 'WCA'):

- barn owl Tyto alba;

- crossbill Loxia sp.; and,
- fieldfare Turdus pilaris.

10.31 Note however that fieldfare rarely breeds in the UK and only does so in the far north of Scotland. The recorded occurrence(s) would undoubtedly have involved wintering fieldfares, which would have no dependence on the Site.

10.32 Records of additional species listed on the Red List of Birds of Conservation Concern (Eaton *et al*, 2015) included: black grouse, curlew *Numenius arquata*, grasshopper warbler *Locustella naevia*, grey partridge *Perdix perdix*, house sparrow *Passer domesticus*, lapwing *Vanellus vanellus*, lesser redpoll *Acanthis cabaret*, song thrush *Turdus philomelos*, spotted flycatcher *Muscicapa striata*, starling *Sturnus vulgaris*, tree pipit *Anthus tribialis*, twite *Linaria flavirostris* and whinchat *Saxicola rubetra*.

10.33 Several of these species are also identified as Species Selected for Action in the Argyll and Bute Local Biodiversity Action Plan.

Methods

Field survey

10.34 Based on the consultation feedback received from SNH, as set out in the Introduction to this Chapter, ornithology survey during the 2020 breeding season was commenced in March and will continue through to completion in August.

10.35 Field survey will replicate that done previously and will follow the same best practice guidelines. This will include:

- vantage point surveys – minimum of six hours observation per month from each of the three VP locations used in 2018/19;
- moorland breeding bird survey – using a modified version of the Brown and Shepherd (1993) methodology, a total of three visits will be completed, covering Development infrastructure plus a 500m buffer. Note that although four survey visits are typically carried out, survey in April 2020 could not be completed due to restrictions associated with Covid-19;
- breeding golden eagle survey – searches out to 6 km from the Proposed Development for breeding golden eagles and monitoring of the breeding success of any nest sites found;
- breeding raptor survey – searches out to 2 km from the Proposed Development for breeding raptors listed on Schedule 1 of the WCA and monitoring of the breeding success of any nests found;
- breeding diver survey – searches of lochans and waterbodies within 1 km of the Proposed Development for breeding red-throated diver and black-throated diver and monitoring of the breeding success of any nests found. At any lochan where a chick is hatched, targeted vantage point watch over that waterbody will be completed with the aim of recording between 20 – 30 foraging flights by the adult birds; and,
- lekking black grouse survey – within 1.5 km of the Development.

Collision Risk Modelling

10.36 Collision risk modelling will be carried out for the Proposed Development. In addition, the collision risk modelling previously undertaken will also be updated using the revised design of the wind farm (i.e. incorporating the reduced number of turbines and the larger turbine sizes). The collision risk modelling will be carried out using two different datasets: one which contains the results of vantage point surveys carried out between 2014 – 2016; and one which uses the results of these surveys between 2018 – 2020. This is because different VP locations were used during these periods, and the results are therefore not directly compatible for the purposes of collision risk modelling.

10.37 Collision risk modelling will be carried out for all target species of the vantage point surveys for which sufficient flight activity within the wind farm area have been recorded. Based on the results of surveys to date, these species will be:

- golden eagle;
- hen harrier;
- golden plover; and,
- kestrel *Falco tinnunculus*.

10.38 Should sufficient levels of flight activity by any other target species be recorded during the course of the 2020 breeding season, these will also be included.

PAT / GET Modelling

10.39 It is not proposed to carry out a Predicting Aquila Territories (PAT) modelling exercise for the Proposed Development to estimate golden eagle habitat use / loss. During PAT, modelling closed canopy forest is assumed to be an existing exclusion zone for golden eagles. Only two of the turbines are located outside of existing forestry so the remaining ten could have no impact on the PAT model's predictions because that part of the landscape is already assumed to be unavailable for golden eagles. Furthermore, the two turbine locations on open ground are beyond the limits of the nearest golden eagle range so could not contribute in the model to any loss of habitat for that pair.

10.40 A preliminary Golden Eagle Topographic (GET) modelling exercise has been completed for the Proposed Development and is reported in Fielding (2019). It found that the Proposed Development would result in the loss of 0.6 km^2 of 'preferred' golden eagle habitat, which would equate to approximately 1.91% of preferred habitat within 5 km of the Proposed Development. It was concluded that Clachaig Glen Wind Farm would have a very small local (within 5 km) effect on the amount of preferred golden eagle habitat, but beyond that the effect would be virtually zero.

10.41 It is not proposed to conduct any additional GET modelling. However, the results described above will be considered as part of the EIA.

Impact Assessment

10.42 The results of the completed field surveys, in combination with the outcomes of desk study and any consultation with relevant stakeholders, will be used to inform the Ecological Impact Assessment (EcIA) component of the EIA. This will be conducted in accordance with the industry-standard guidelines produced by CIEEM (CIEEM, 2018). Where significant effects on an ornithological feature are predicted by the EcIA, appropriate mitigation measures will be proposed. Likely mitigation measures are outlined in mitigation section below. Enhancement measures that are proportionate to the impact of the Proposed Development will also be considered in pursuance of the objective of Scottish Planning Policy to achieve net biodiversity gains from development.

Potential Significant Effects

10.43 The potential significant effects of the Proposed Development on ecological features can be categorised as follows:

- loss of habitat which supports bird species as a result of the construction of infrastructure (e.g. access tracks, turbine hard-standings etc.);
- disturbance to and/or displacement of species whilst at the nest, displaying or foraging (e.g. noise disturbance during construction or displacement from the wind farm area during operation);
- barrier effects by which birds are deterred from using normal routes to feeding or roosting grounds;
- accidental destruction of active bird nests; and,

- death of birds through collision or interaction with wind turbine blades or other infrastructure.

10.44 No flights by Greenland white-fronted geese within 500m of the proposed turbines have been recorded since 2014. The nearest part of the Kintyre Goose Roosts SPA / Ramsar site is approximately 3 km from the proposed turbine locations. It is therefore very unlikely that there will be any effects on Greenland white-fronted geese or on this European site. However, this will be assessed in more detail as part of a Habitats Regulations Appraisal (HRA) screening exercise and reported in an HRA Screening Report. As it is not anticipated that any likely significant effects on the Kintyre Goose Roosts SPA / Ramsar site will be identified, it is not currently proposed that the next stage of HRA (Appropriate Assessment) will be required.

Mitigation Measures

10.45 Compliance with planning policy requires that the Proposed Development considers and engages the following mitigation hierarchy where there is potential for impacts on relevant ornithological features:

1. avoid features where possible;
2. minimise impact by design, method of working or other measures (mitigation), for example by enhancing existing features; and,
3. compensate for significant residual impacts (e.g. by providing suitable habitats elsewhere).

10.46 This hierarchy requires the highest level to be applied where possible. Only where this cannot reasonably be adopted should lower levels be considered.

10.47 At this stage in the design of the Proposed Development, it is not possible to make detailed recommendations for mitigation. The requirement for specific mitigation will be determined based on the results of desk study and field survey work and the subsequent EcIA.

10.48 However, it is likely that the following generic mitigation measures will be required to reduce the impacts of the Proposed Development:

- removal of habitat which may be suitable for nesting birds outside of the breeding season (taken to be March to August, inclusive);
- pre-construction and pre-felling checks for nesting birds;
- implementing works exclusion zones around specially protected species to ensure that they are not disturbed or otherwise directly harmed during construction;
- timing of works to avoid sensitive periods of the day (e.g. avoiding the period around dawn when black grouse lekking activity is at a peak).

10.49 Note that the measures described above, in addition to those which are designed as part of the EIA process, will be incorporated into a Habitat Management Plan (HMP). In addition, a Construction Environment Management Plan (CEMP) will be prepared detailing pollution prevention measures to be implemented during the construction phase of the Proposed Development.

Summary and Conclusions

10.50 Detailed ornithological study, including desk-based research and targeted field survey, was completed at the Site in between 2014 – 2016 and in 2018 and 2019. This work covered the area relevant to the layout of the Proposed Development as currently proposed, as there has been no change since the 2016 planning application (other than the removal of two turbines and the roads, hard-standings and other infrastructure associated with them).

10.51 Following advice provided by SNH during consultation held with them in 2020, further ornithological field survey will be carried out during the 2020 breeding season. This will seek to replicate the work done previously and will follow the same best practice methods.

10.52 The potential effects of the Proposed Development will be assessed, using the baseline information collected between 2014 – 2020, and the results of updated collision risk modelling

(which will use all of the data collected during this time period), following the methods for Ecological Impact Assessment described by CIEEM.

10.53 Appropriate mitigation will be developed and implemented to minimise the impacts of the Proposed Development. Where significant effects cannot be avoided, proportionate compensatory measures will be provided. Where possible, enhancement measures which will benefit bird species will also be suggested and incorporated into the Proposed Development.

References

Brown, A.F. and Shepherd, K.B. (1993). A method for censusing upland breeding waders. *Bird Study* **40**: pp 189 – 195.

Calladine, J., Garner, G., Wernham, C. and Thiel, A. (2009). The influence of survey frequency on population estimates of moorland breeding birds. *Bird Study* **56 (3)**: pp 381 – 388.

CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Version 1.1 – updated September 2019. Chartered Institute of Ecology and Environmental Management, Winchester.

Eaton, M., Aebischer, N., Brown, A., Hearn, R., Lock, L., Musgrove, A., Noble, D., Stroud, D. and Gregory, R. (2015). Birds of Conservation Concern 4: the population status of birds in the UK, Channel Islands and Isle of Man. *British Birds* **104**, pp 708 – 746.

E.ON/AECOM (2016a). Clachaig Glen Wind Farm Environmental Statement, Volume 2a Main Text.

E.ON/AECOM (2016b). Clachaig Glen Wind Farm Environmental Statement, Volume 2b Figures.

E.ON/AECOM (2016c). Clachaig Glen Wind Farm Environmental Statement, Volume 3 Appendices. Appendix 10.1.

E.ON/AECOM (2016d). Clachaig glen Wind Farm Environmental Statement, Volume 4 Confidential Annex.

Fielding, A. (2019). Clachaig Glen Wind Farm Ornithological Monitoring Report. April 2019.

Gilbert, G., Gibbons, D.W. and Evans, J. (1998). Bird Monitoring Methods. The Royal Society for the Protection of Birds, Sandy.

Hardey, J., Crick, H., Wernham, C., Riley, H., Etheridge, B. and Thompson, D. (2013). Raptors: A Field Guide for Surveys and Monitoring. 3rd edition. The Stationary Office, Edinburgh.

SNH (2017). Recommended bird survey methods to inform impact assessment of onshore wind farms. Version 2, March 2017.

11. Geology, Hydrology and Hydrogeology

Introduction

11.1 The EIA will consider the potential issues arising from the construction, operation and decommissioning of the Proposed Development in relation to existing and future potential geological, hydrological and hydrogeological conditions.

11.2 It will assess the potential effects on surface and ground waters, including Ground Water Dependant Terrestrial Ecosystems (GWDTEs) and Private Water Supplies, as well as the ground conditions. The assessment will provide baseline information; discuss potential mitigation and management measures and assess the significance of residual impacts assuming the proposed mitigation is implemented.

11.3 The majority of mitigation measures for potential effects on geology, hydrology and hydrogeology are embedded into the wind farm design process. The infrastructure layout will be influenced by ground conditions, topography and sensitive receptors.

Baseline

Surface Water Features

11.4 The entire Proposed Development Site ('Site') is part of the Mull of Kintyre West Coastal catchment and is drained by two main tributaries, the Clachaig Water and Barr Water, as shown on Figure 11.1.

11.5 There are a number of surface water features present within the Site including various small burns (streams) and drains.

11.6 The majority of the Site is drained by the Clachaig Water which originates at Loch na Naich to the northeast of the Site and runs in a south westerly direction through the Site into the Mull of Kintyre West Coastal catchment, approximately 1.8 km south west of the Site.

11.7 The area of the Site located to the east of the rocky outcrops, which runs north to south along the eastern boundary, drains into the Barr Water. The Barr Water originates from Loch Losgainn, located to the northeast of the Site, and runs in a south / south westerly direction, adjacent to the eastern boundary of the Site and the Mull of Kintyre West Coastal catchment approximately 6.2 km south west of the Site.

Flood Risk

11.8 A screening review of the SEPA's online indicative flood map shows the Site can be subject to river flooding and surface water flooding. The likelihood of river flooding in the Clachaig Water is classed as being High, and the likelihood of surface water flooding is classed as high in a few small and localised instances. The Barr Water has associated floodplains located out with the Site boundary.

11.9 Although the likelihood of river flooding is classed as being High, the extent of the flooding is wholly contained within the banks of the Clachaig Water. Surface water flooding is shown as a series of small areas of High likelihood, which is likely associated with the peat deposits present across the Site as detailed in the original 2016 EIA peat probing work.

11.10 Based on this screening review, it is considered that flooding is isolated within the banks of the Clachaig Water or to small localised areas of surface water and therefore the area can be considered to be a low risk area for flooding and no further assessment is required to be undertaken in terms of flood risk to the Proposed Development.

11.11 As part of the EIA, impacts of downstream flooding, particularly on the Clachaig Water, will be assessed.

Water Resources

11.12 Under The Private Water Supplies (Scotland) Regulations (2006), councils have a duty to hold data on private water supplies (PWS) in their area and monitor the quality of the supplies. The Argyll and Bute Council (ABC) will be contacted with regards to the presence of private water supplies either within or close to the Site. Further consultation with homeowners within 1 km of the Site will be undertaken using a questionnaire to support the information obtained from ABC.

11.13 Should the distances between proposed infrastructure and known PWS be greater than the SEPA buffers, PWS will not be assessed further.

Geology

Superficial

11.14 A review of British Geological Survey (BGS) online Onshore GeoIndex viewer indicates that the only superficial surface cover within the site is glacial till. This is likely to be thin in areas of raised elevation e.g. the ridge running along the east side of the Site, and other localised raised areas. At these locations rock will be at or close to the surface.

11.15 A supplementary review of the Nation Soil Map of Scotland shows that the majority of the Site comprises peaty gleys and peat: peaty podzols and peaty rankers. Blanket peat is noted over a sizeable area in the south of the developable area, and the ridgeline to the east is indicated to comprise peaty gleys and peat: some peaty podzols.

Bedrock

11.16 A review of the BGS online Onshore GeoIndex viewer indicates that the majority of the Development Site lies within an area of bedrock dominated sedimentary rock, namely limestone, psamite and pelite. Metamorphic intrusions are present across the Development Site as is one igneous intrusion.

11.17 Below list the various formations, from east to west, identified within the Site:

- Beinn Bheula Schist Formation: consisting of gritty psammites and pelites;
- Green Beds Formation: Meta-volcanoclastic sedimentary rock;
- Glen Sluan Schist Formation: Psammite and semipelite;
- Loch Tay Limestone Formation: Meta-limestone;
- Stonefield Schist Formation: Semipelite;
- Neoprotorezoic basic minor intrusions are present within the above rock formations;
- Metaigneous Rocks: Amphibolite;
- Igneous Rocks: Intrusions of olivine-dolerite, and analcite-olivine-dolerite; and
- Bellochantuy Bay Formation: Sandstones and breccias (on the western site boundary).

Ground Contamination

11.18 Given the historical use as a commercial forestry and absence of development, it is unlikely that the Site is contaminated. However, information regarding pollution incidents and previous uses will be collated. It is noted that contamination was not identified as a significant risk in the 2016 EIA.

Deforestation

11.19 The Proposed Development would involve felling of trees to allow installation of new access tracks, wind turbines and other associated infrastructure, which has the potential to affect the surface water and groundwater environment. The potential effect of deforestation will be considered with any appropriate mitigation measures as detailed in Chapter 17: Forestry.

Methods

Study Area

11.20 The study area will be the site boundary, as shown on Figure 11.2, plus a buffer area of 1 km.

Desk Based Studies

11.21 It is recognised that a variety of data is available from third parties i.e. BGS, SEPA and SNH. It is therefore proposed that the following tasks will be undertaken to ensure the baseline data informs the impact assessment:

- Review of Ordnance Survey (OS) maps to identify surface water features;
- Review of the SEPA River Basin Management Plan (RBMP);
- Identification of the locations and characteristics of catchments, surface water features and springs within;
- Identification of Water Framework Directive (WFD) classifications and objectives;
- Collation of data and location of abstractions and discharges consents within the study area;
- Collation of information on climate, surface hydrology, water quality and flood risk;
- Identification of hydrogeological conditions and groundwater resources;
- Review of bedrock and superficial geology maps;
- Review of the National Soil Map of Scotland;
- Review of historic maps; and
- Review of aerial photography.

11.22 The data review will include a search for nationally protected geological SSSI or Regionally Important Geological Sites (RIGS) or protected geo-morphological features within the vicinity of the proposed development.

11.23 No mining features were identified during the course of the assessment using sources from BGS and the Coal Authority interactive map.

Peat Risk Assessment

11.24 AECOM's approach will be guided by relevant legislation (including waste management legislation) and the following best practice guidance documents:

- Developments on Peatland: Guidance on the assessment of peat volumes, reuse of excavated peat and the minimisation of waste (Scottish Renewables and SEPA, Version 1, 2012);
- Peatland Survey. *Guidance on Developments on Peatland, online version only.* (Scottish Government, Scottish Natural Heritage, SEPA, 2017);
- Good Practice during Wind Farm Construction (Scottish Renewables, Scottish Natural Heritage, SEPA, Forestry Commission Scotland, Historic Environment Scotland and Marine Scotland Science, Version 4, 2019);
- Floating roads on peat (Forestry Civil Engineering and Scottish Natural Heritage, 2010);
- Regulatory position statement – Developments on peat (SEPA, 2010); and
- Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Scottish Government, 2017).

Walkover Survey

11.25 A site walkover was undertaken by an AECOM geotechnical specialist and geologist at the Site between Monday 30 September and Friday 4 October 2013 as part of the 2016 EIA. For the purposes of subsequent reporting, the Site was split into areas A-F (Figure 11.2). The findings of this are summarised below:

- The ground comprises densely forested blocks of trees split by breaks, which are sometimes wet and boggy underfoot, particularly in Area B;
- An area of windblown trees is located in the southwest corner of Area A;
- No areas of peat instability were noted;
- Bedrock was noted as being frequently exposed in the open section of the hillside to the east of the Development Site (Area C) and the adjacent sloping forestry ground. Over the central and western areas of the site, shallow / exposed bedrock was frequently noted in access track cuttings, and locally within stream cuttings;
- An existing quarry presumed to be used for the existing access track construction is located adjacent to the site boundary where the access track enters the Development Site to the north;
- Access tracks throughout the Development Site are generally in good condition with no signs of obvious surface settlement or failures noted and are more extensive than indicated on the existing OS maps; and
- No mining features were identified.

Phase 1 Peat Investigation

11.26 Phase 1 peat depth survey work was undertaken by an AECOM geotechnical specialist and geologist at the Site between Monday 30 September and Friday 4 October 2013, as part of the site walkover survey noted above. A subsequent visit was made on Monday 27 and 28 January 2014 to undertake further peat survey work for additional areas within the Site.

11.27 As noted during the site walkover, an area of windblown trees were present in the southwest corner of Area A, which resulted in limited coverage in this area.

Phase 2 Peat Investigation

11.28 Phase 2 peat depth survey work was undertaken on 9 and 11 February 2016.

11.29 In total, 493 probes were taken, the results of which are shown on Figure 11.3 and Figure 11.4. Peat depths across the Site vary between 0.5m and 5.6m. Secondary probes undertaken at approximately 5m distance to primary probe locations showed minimal local variation in peat depths, other than in Area C as described below. Phase 2 peat probing confirmed findings from the Phase 1 surveys.

11.30 The deepest areas of peat, 3m to greater than 5m, were generally encountered to the south and east of the Site in areas of gently sloping topography, often with no trees. Deep peat was also encountered within level areas along the additional land at the north boundary of the Site (Area E). In general, areas of peat encountered were consistent with the peat extents shown on the Scotland Soils map, although local peat depths encountered were greater than expected over the high ground in Area C.

<u>Area A</u>

11.31 Across the area peat depths are typically less than 0.5m, with occasional isolated pockets up to approximately 2m depth.

Area B

11.32 Maximum peat depths in the area are to the south and were found to range between 2.5m to greater than 5m, typically in areas of no tree planting. Peat depths were found to reduce towards the north of the area, and typically ranged between 0.1 and 1m.

Area C

11.33 Peat depths were found to vary widely over short distances between topographically level areas and sloping ground. Maximum peat depths of 5m and greater were encountered in level areas between peaks. Over areas of steeper ground with frequent exposed rock, typical depths encountered were less than 0.5m.

Area D

11.34 Peat depths are typically around 0.5 to 1m depth. Localised level areas to the far north east of the area typically contain peat of around 2 - 3m depth.

Area E

11.35 Peat depths are typically <1m depth within areas of higher sloping ground to the east and west, with local pockets up to 2m also present. The low-lying level ground running north-south to the centre of the Site contains peat depths up to 5.6m. An area of deeper peat deposits of up to 3m was also encountered within level areas by the forest boundary around the western extents of the area.

Area F

11.36 No peat was encountered during probing within this area.

Summary

11.37 Due to the information gathered to date as part of the 2016 EIA for the approved scheme and that the infrastructure layout is largely remaining the same (apart from some minor adjustments of roads and larger crane pads) , it is proposed that further peat depth surveys are not required as part of the upcoming EIA application and that further information can be gathered post consent. Furthermore, it is noted that no adverse impacts on peat were identified in the 2016 EIA.

Carbon Calculation

11.38 The latest Scottish Government Carbon Calculator for wind farms on Peatlands will be used to estimate the carbon losses and gains from the Proposed Development. The carbon calculator is accessible online, and this web-based version of the calculator supersedes all previous excel based versions of the tool. The methodology is based on Nayak et al, 2010 'Calculating carbon savings from wind farms on Scottish peat lands – A New Approach'. It is noted that in the 2016 EIA it was expected to take 2.3 years for the carbon lost during wind farm construction (including through turbine manufacture, construction of foundations, and excavation of peat) to be 'paid back' by the carbon saved through generating electricity from a renewable energy resource. As the Proposed Development represents a more efficient wind farm scheme this 2.3 year timeframe is anticipated to be reduced.

Hydrology & Hydrogeology Assessment

11.39 A qualitative assessment will be undertaken using a combination of relevant legislation, other statutory policies and guidance, and professional judgment. Key acts of legislation, policy and guidance which will be considered in the preparation of this assessment include:

- Water Framework Directive (2000/60/EC);
- Water Environment and Water Services (Scotland) Act 2003;
- Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended);
- Good Practice during Wind Farm Construction (Scottish Renewables et al, 2019);

- Engineering in the Water Environment Good Practice Guide – Bank Protection Rivers and Lochs (SEPA, 2008);
- Engineering in the Water Environment Good Practice Guide - Construction of River Crossings (SEPA, 2010);
- Engineering in the Water Environment Good Practice Guide – Sediment Management (SEPA, 2010);
- CIRIA* Report C502: Environmental Good Practice on Site (CIRIA, 2015);
- CIRIA Report C532: Control of Water Pollution from Construction Sites (CIRIA, 2001);
- Scottish Planning Policy (SPP) (2014);
- SEPA Position Statement WAT-PS-06-02 – Culverting of Watercourses (SEPA, 2015); and
- Guidance for Pollution Prevention (GPPs) and Pollution Prevention Guidelines (PPGs)**.

**CIRIA – Construction Industry Research and Information Association*

***The GPPs are a guidance series replacing the PPGs. Any PPGs listed in the EIA are considered as a source of information on good practice only.*

11.40 The assessment will identify potential effects mainly due to construction and decommissioning of the access tracks, watercourse crossings, turbine foundations, cable trenches, compound and storage areas etc. as well as effects during the operational period. The potential effects identified include the following:

- Increased run-off on exposed ground causing pollution or leading to increased flood risk;
- Disturbance or erosion of bed and banks of watercourses and land drains;
- Increased run-off from hardstanding areas causing pollution or leading to increased flood risk;
- Dewatering of groundwater and peat during foundation construction;
- Pollution from accidental spillages;
- Cutting off natural surface and groundwater pathways; and
- Leaching of concrete into groundwater and peat.

11.41 Potential effects on watercourses will be reduced by minimising the number of crossings required, where possible.

11.42 Practical mitigation measures will be proposed to remove, reduce or offset predicted significant adverse effects and these will feed into the scheme layout and design detail.

Potential Significant Effects

11.43 Through the implementation of embedded mitigation into the design process no adverse significant effects are anticipated. Carbon release will be offset through renewable energy generation and is anticipated to occur quicker than the 2.3 year estimate in the 2016 EIA due to a more efficient wind farm scheme being introduced. Other than this, it is expected that through a combination of good practice and extensive design reviews, all potential adverse significant effects can be appropriately mitigated utilising the mitigation measures specified below.

Mitigation Measures

11.44 The EIA will consider appropriate mitigation measures to reduce the impact of any of the potential effects. The mitigation measures will be based on current environmental good practice guidance and will include completion of the following:

- Watercourse Crossing Strategy;
- GWDTE Assessment;
- Peat Slide Risk Assessment;
- Carbon Balance Assessment;
- End User Private Water Supply (PWS) Questionnaire;
- Existing Controlled Activities Regulations (CAR) Licenses; and
- Peat Balance Calculations.

Summary and Conclusions

11.45 The EIA will assess the geological, hydrogeological and hydrological impacts of the Proposed Development including the potential effects on aquifers, surface waters, water dependant habitats, including GWDTEs and human use of water resources. It is noted that the 2016 EIA concluded that no adverse significant impacts were anticipated on Geology, Hydrology or Hydrogeology.

11.46 The EIA will include a review of historic uses to confirm the assumption that the probability of encountering any contaminated land is low.

11.47 The effects of the Proposed Development will be assessed for the construction, operational and decommissioning phases.

11.48 Due to the information gathered to date, it is proposed that further peat depth surveys are not required as part of the EIA and that further information can be gathered post consent.

11.49 Based on this screening review, it is considered that flooding is isolated within the banks of the Clachaig Water or to small localised areas of surface water, as identified in the 2016 EIA, and therefore the area can be considered to be a low risk area for flooding and no further assessment is required to be undertaken.

11.50 Overall, Geology, Hydrology and Hydrogeology is scoped into the upcoming EIA.

References

British Geological Survey online Onshore GeoIndex. [Online]
Available: https://mapapps2.bgs.ac.uk/geoindex/home.html
[Accessed: 11/06/20]

CIRIA. (2001). Report C532. Control of Water Pollution from Construction Sites. [Online]
Available:
https://www.thenbs.com/PublicationIndex/documents/details?Pub=CIRIA&DocId=252367
[Accessed: 11/06/20].

CIRIA. (2015). Report C741. Environmental Good Practice on Site Guide. [Online]
Available:
https://www.thenbs.com/PublicationIndex/documents/details?Pub=CIRIA&DocID=256259#
[Accessed: 11/06/20].

European Commission. (2000). Water Framework Directive (2000/60/EC). [Online]
Available: http://ec.europa.eu/environment/water/water-framework/index_en.html
[Accessed: 09/06/20].

Forestry Civil Engineering and Scottish Natural Heritage. (2010). Floating roads on peat. [Online]
Available: http://www.roadex.org/wp-content/uploads/2014/01/FCE-SNH-Floating-Roads-on-Peat-report.pdf.
[Accessed: 10/06/20].

Scotland's Soils' National Soil Map of Scotland. [Online]
Available: https://soils.environment.gov.scot/maps/soil-maps/national-soil-map-of-scotland/
[Accessed: 11/06/20]

Scottish Government. (2006). The Private Water Supplies (Scotland) Regulations. [Online]
Available: http://www.gov.scot/Topics/Environment/Water/17670/pws
[Accessed: 09/06/20].

Scottish Government (2014). Scottish Planning Policy. [Online]
Available: https://www.gov.scot/publications/scottish-planning-policy/
[Accessed: 09/06/20].

Scottish Government. (2017). Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments. [Online]
Available: https://www.gov.scot/publications/peat-landslide-hazard-risk-assessments-best-practice-guide-proposed-electricity/
[Accessed: 12/06/20].

Scottish Government, Scottish Natural Heritage, SEPA. (2017). Peatland Survey. Guidance on Developments on Peatland, online version only.
Available: https://www.gov.scot/publications/peatland-survey-guidance/
[Accessed: 12/06/20].

Scottish Natural Heritage, SEPA, Scottish Government and The James Hutton Institute. (2011). Developments on Peatland: Site Surveys and Best Practice. [Online]
Available: https://www.sepa.org.uk/environment/energy/renewable/
[Accessed: 10/06/20].

Scottish Renewables and SEPA. Version 1 (2012). Developments on Peatland: Guidance on the assessment of peat volumes, reuse of excavated peat and the minimisation of waste. [Online]
Available: http://www.gov.scot/Topics/Business-Industry/Energy/Energy-sources/19185/17852-1/CSavings/guidancepeatwaste
[Accessed: 10/06/20].

Scottish Renewables, Scottish Natural Heritage, SEPA, Forestry Commission Scotland, Historic Environment Scotland and Marine Scotland Science, Version 4. (2019). Good Practice during Wind Farm Construction. [Online]
Available: https://www.nature.scot/guidance-good-practice-during-wind-farm-construction
[Accessed: 12/06/20].

SEPA. Flood Maps. [Online]
Available: https://www.sepa.org.uk/environment/water/flooding/flood-maps/
[Accessed: 09/06/20].

SEPA. Guidance for Pollution Prevention (GPPs) and Pollution Prevention Guidelines (PPGs). [Online]
Available: https://www.sepa.org.uk/regulations/water/guidance/
[Accessed: 11/06/20].

SEPA. (2008). Engineering in the Water Environment Good Practice Guide – Bank Protection Rivers and Lochs. [Online]
Available: https://www.sepa.org.uk/media/150971/wat_sg_23.pdf.
[Accessed: 11/06/20].

SEPA. (2010). Engineering in the Water Environment Good Practice Guide - River Crossings. [Online]
Available: https://www.sepa.org.uk/media/151036/wat-sg-25.pdf.
[Accessed: 11/06/20].

SEPA. (2010). Engineering in the Water Environment Good Practice Guide – Sediment Management. [Online]
Available: https://www.sepa.org.uk/media/151049/wat-sg-26.pdf.
[Accessed: 11/06/20].

SEPA. (2010). Regulatory position statement – Developments on peat. [Online]
Available: https://www.sepa.org.uk/media/143822/peat_position_statement.pdf.
[Accessed: 10/06/20].

SEPA. (2015). Position Statement 06 – 02: Culverting of Watercourses – Position Statement and Supporting Guidance. [Online]
Available: https://www.sepa.org.uk/regulations/water/engineering/engineering-guidance/
[Accessed: 09/06/20].

The National Archives. (2003). Water Environment and Water Services (Scotland) Act 2003. [Online]
Available: http://www.legislation.gov.uk/asp/2003/3/contents
[Accessed: 09/06/20].

The National Archives. (2004). The Water Environment (Register of Protected Areas) (Scotland) Regulations 2004. [Online]
Available: http://www.legislation.gov.uk/ssi/2004/516/contents/made
[Accessed: 09/06/20].

The National Archives. (2011). The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended). [Online]
Available: http://www.legislation.gov.uk/ssi/2011/209/contents/made
[Accessed: 09/06/20].

12. Cultural Heritage

Introduction

12.1 The aim of this Scoping Assessment is to complete sufficient assessment to identify potential historic environment constraints associated with the Proposed Development and the potential for the proposed scheme to result in significant effects on heritage assets. It provides the methodology for assessment for the EIA.

12.2 Heritage assets can include:

- Buried archaeological remains;
- Earthwork features;
- Features of cultural significance and importance;
- Built heritage; and
- Designated features such as scheduled monuments, listed buildings, entries on the Inventory of Gardens and Designed Landscapes, entries on the Inventory of Registered Battlefields and conservation areas.

Legislation, Planning Policy and Guidance

12.3 Legislation and guidance relating to cultural heritage and pertinent to this project includes:

- Historic Environment Scotland Act 2014;
- Historic Environment (Amendment) (Scotland) Act 2011;
- The Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997;
- Ancient Monuments and Archaeological Areas Act 1979;
- Scottish Planning Policy (SPP) Paragraphs 135-151: Valuing the Historic Environment, 2014 (Scottish Government 2014a);
- Historic Environment Scotland Policy for Scotland, (HES 2019a)
- Historic Environment Circular: Regulations and Procedures. Historic Environment Scotland, 201 (HES 2019b);
- Our Place in Time - The Historic Environment Strategy for Scotland, 2014 (Scottish Government 2014b);
- Planning Advice Note (PAN) 2 / 2011 – Planning and Archaeology (Scottish Government 2011);
- Planning Advice Note 71 – Conservation Area Management (Scottish Government 2004);
- Managing Change in the Historic Environment: Setting guidance note (HES 2016):
- Environmental Impact Assessment Handbook (Scottish Natural Heritage (SNH) and HES 2018):
- Argyll and Bute Council and Historic Scotland Historic Environment Strategy 2015-2020: and
- Argyll and Bute Local Development Plan (adopted March 2015)
  - Strat 1 – Sustainable Development. This policy states that developers should demonstrate sustainable principles including conserving and enhancing the building environment by avoiding significant adverse impacts upon built heritage resources.
  - Policy LDP 3 – Protecting, Conserving and Enhancing our Outstanding Environment Together. This policy states that a proposal for a development will not be supported where it does not protect, conserve, or enhance the character of the built environment or where

a development significant adversely affects, including cumulative effects, built environment sites.

- Policy LDP 6 – Supporting the Sustainable Growth of Renewables. This policy states that renewable energy developments will be supported where it can be demonstrated that there will be no 'unacceptable adverse impacts' upon the historic environment. Applications for wind turbine developments will be assessed against a set of criteria including impacts on the historic environment including Scheduled Monuments, listed buildings and their settings.

Baseline

Study Area

12.4 For the cultural heritage scoping assessment for Clachaig Glen wind farm, the study area for heritage assets is 1km from the Site boundary.

12.5 A flexible approach will be undertaken for the identification of high value assets on which there may be an impact upon setting. This will be guided by the Scheme's Zone of Theoretical Visibility (ZTV) (refer to ***Chapter 7: Landscape and Visual***, of this Scoping Report), but will also consider physical and historical connectivity and relationships with other heritage assets, designed views, and the wider landscape.

Scoping Methodology

12.6 To undertake this initial assessment data were collected for the study area from:

- Clachaig Glen Environmental Impact Assessment. AECOM, 2016.
- Pastmap;
- West of Scotland Archaeology Service (WoSAS);
- Argyll and Bute Council website; and
- Historic Environment Scotland website.

12.7 The assessment has been undertaken following the Chartered Institute for Archaeologists (CIfA) 'Standards and Guidance for Historic Environment Desk-Based Assessment' (CIfA, 2017) as well as Historic Environment Scotland guidance, such as those listed above.

Designated Heritage Assets

12.8 There are six scheduled monuments, all dated to the prehistoric period, within, or just outside of, the 1 km study area of the Proposed Development site. The location of these assets can be seen on Figure 12.1, Designated Heritage Assets. The first is a stone, now split in half, which bears cup and ring marks (4352). The second is an example of rock art panels that are in three areas but are grouped as one Scheduled Monument (13295, 38579). There is one dun[9], known as Dunan Muasdale (3223), and a fort located north east of Killean (3179). A later prehistoric enclosure (3659) that is a good example of settlement during this period is located in the south west of the study area. The final scheduled monument is the remains of St John's Church and its associated burial ground with carved stones.

12.9 There are 10 listed building in the study area. Four Category A listed buildings form the four sections of the property known as The Doll's Houses in Killean. This grouping includes the Category A listed Arts and Crafts cottages which once housed the Killean Estate workers and one Category B listed building which was the school. The other listed buildings form part of the Killean estate. This includes the Category A listed Killean House, the lodge, gate piers, wing walls and railings of Killean House and Killean Home Farm, which is listed in three individual parts, all of which are Category B listed.

[9] Dun – A building or settlement enclosure with a thick drystone wall, generally circular or oval in plan, usually sited in an elevated position.

12.10 There are no World Heritage Sites, Registered Battlefields, entries on the Inventory of Gardens and Designed Landscapes, or conservation areas within the 1 km study area.

Non - Designated Heritage Assets

12.11 A significant number of the heritage assets recoded within the 1km study area date to the prehistoric era (up to 450 AD). In addition to the scheduled rock art panels a further seven examples are recorded within the 1km study area. There are also 27 stones which bear cup and ring marks in various states of preservation. Two duns, believed to be defensive in nature, are located within the 1km study area with many more in the wider area. Several cairns and individual finds, including an ard and lithic tools, are also recorded.

12.12 Recorded evidence for periods up to the post-medieval is limited within the study area. There are no assets dating to the early medieval period (450 to 1066). At this time the Gaelic kingdom of Dál Riata emerged on the western part of Scotland, then known as Pictland. The capital of Dál Riata was located at Dunadd hillfort, Kilmartin some 60 km north of the Proposed Development site. During the late 8th to early 9th centuries, the kingdom of Dál Riata experienced Norse invasions. This pushed the Dál Riata tribes further into Pictish territories. Gradual Norse settlement during the 8th and 9th centuries led to the diminishment of the Kingdom of Dál Riata in Argyll. Along the western coast there was a fusion of cultures as Gaelic, Pictish, Anglican and Scandinavian backgrounds mixed.

12.13 Two assets within the study area date to the medieval period (1066 to 1500), an enclosure and the site of lazy beds. Evidence of defended settlements and forts in the wider area allude to the continued threat from the Norse in the early part of the period and later to the power struggle between the clans in the region.

12.14 The post-medieval period is represented by the most previously recorded assets with the study area. Most of the assets relate to agriculture such as farmsteads, crofts, sheepfolds, enclosures, a corn drying kiln and shieling huts. There is one domestic dwelling known as High Clachaig House and a church. Industrial assets include lime kilns, a bloomery and quarries. All of the listed building within the study area are post-medieval in date.

12.15 The historic maps show open countryside in the area of the Development with very few trees or plantations. These uncovered uplands were used by the population for grazing purposes. Documentary evidence for the area is limited, although surviving archaeological remains and comparisons with other similar landscapes suggests that the main settlements were concentrated on the lower land, with the upland areas used for transhumance. This practice involved the movement of livestock to the higher ground during the summer months, enabling the population to exploit the grazing available and protect the cultivable land that existed in the lower areas.

12.16 Although assets dating to the modern period are limited, the opening years of the 20th century continued to see a population based on agriculture. This continued to form a major part of landscape use in the study area until the second half of the 20th century when large scale forestry was established in the area. As a result of this the majority of the study area, and almost all of the land available for turbine development, is now occupied by forestry plantations.

Methods

12.17 It is proposed that cultural heritage (archaeology, built heritage and historic landscapes) should be scoped into the EIA due to the potential for the Proposed Development to affect designated and non-designated heritage assets. The aim of the cultural heritage assessment will be to establish the baseline conditions for the archaeological resource and the significance of the heritage assets within the Site and a 1km buffer around the red line boundary.

12.18 An additional, wider study area will be established, based on the Zone of Theoretical Visibility (ZTV) of the Proposed Development, in order to assess the potential changes to the setting of designated heritage assets as a result of the Proposed Development. This will be undertaken in close coordination with the Landscape and Visual Assessment team.

12.19 The proposed methodology set out below aims to establish the baseline conditions for the cultural heritage resource within the Site and wider study area. The baseline will inform the impact

assessment set out in the EIA Cultural Heritage chapter, which will assess the impacts and effects of the Proposed Development and set out methods to mitigate adverse effects.

Establishing the Baseline

12.20 A combined detailed assessment of cultural heritage assets will be necessary in order to assess the potential impacts of the Proposed Development.

12.21 In order to place the Site in its full archaeological and historical context, baseline information will be collected on the known heritage assets within the study area. Specifically, the baseline report will:

- Identify all known designated and non-designated heritage assets and/or areas within the Site and in the study area;
- Assess the condition, significance and setting of any heritage assets within the Site and the study area; and
- Identify any heritage assets outside the study area where their condition, significance and setting could be affected by the Proposed Development.

12.22 Baseline data sources will include, but may not be limited to:

- Clachaig Glen EIA. AECOM, 2016
- Details of designated assets from Pastmap (https://pastmap.org.uk/);
- Historic Environment Record data from the West of Scotland Archaeology Service (WoSAS);
- Argyll and Bute Council website;
- Historic Environment Scotland website;
- Various online resources including the British Geological Survey (BGS) Geology of Britain Viewer and the local planning portal for the Local Plan and other planning information;
- Existing geotechnical data;
- Available LiDAR and aerial photography; and
- Documentary, cartographic and other resources as deposited within the local Archives and the National Library of Scotland.

12.23 The study area for the baseline assessment will consist of a 1km buffer surrounding the red line boundary of the Site. The study area has been defined through consideration of the condition of the Site and the development design. Within this area, the known heritage resource will be reviewed to assess the archaeological potential of the site. A flexible approach will be taken to the identification of high value assets on which there may be an impact upon setting. This will be guided by the Scheme's Zone of Theoretical Visibility (ZTV) (refer to ***Chapter 7: Landscape and Visual***, of this Scoping Report), but will also consider physical and historical connectivity and relationships with other heritage assets, designed views, and the wider landscape

12.24 The baseline will draw on the environmental impact assessment (AECOM 2016) previously produced for the site and supplemented with additional information, where relevant, with additional available data and a site visit.

12.25 The assessment will be undertaken following the Chartered Institute for Archaeologists (CIfA) Standards and Guidance for Historic Environment Desk-Based Assessment (2017), The Environmental Impact Assessment Handbook (SNH and HE 2018) and Historic Environment Scotland's guidance on setting (2016).

Sensitivity

12.26 The significance (heritage value) of a heritage asset is determined by professional judgement, guided by, but not limited to, any designated status the asset may hold. The value of an asset is also judged upon a number of different factors including the special characteristics the assets might hold which can include evidential, historical, aesthetic, communal, archaeological, artistic and architectural values. This value of a heritage asset is assessed primarily in accordance with

the guidance set out in Scottish Planning Policy (SPP, 2014) and the Historic Environment Scotland Policy Statement (HESPS 2019). The significance of a place is defined by the sum of its heritage values. Taking these criteria into account, each identified heritage asset can be assigned a level of significance (heritage value) in accordance with the scale as set in Table 12.1.

Table 12.1: Criteria for Determining the Significance (heritage value) of Heritage Assets

Significance (Heritage Value)	Criteria
High	Assets of inscribed international importance, such as World Heritage Sites, Category A and B listed buildings, Landscapes on the Inventory of Gardens and Designed Landscapes, Inventory of Historic Battlefields, Scheduled monuments, Non-designated archaeological assets of schedulable quality and importance.
Medium	Category C listed buildings, Conservation Areas, Locally listed buildings included within a conservation area Non-designated heritage assets of a regional resource value.
Low	Non-designated heritage assets of a local resource value as identified through consultation, Locally listed buildings Non-designated heritage assets whose heritage values are compromised by poor preservation or damaged so that too little remains to justify inclusion into a higher grade

12.27 Having identified the significance of the heritage asset, the next stage in the assessment is to identify the level and degree of impact to an asset arising from the development. Impacts may arise during construction or operation and can be temporary or permanent. Impacts can occur to the physical fabric of the asset or affect its setting.

12.28 When professional judgement is considered, some sites may not fit into the specified category in this table. Each heritage asset is assessed on an individual basis and takes into account regional variations and individual qualities of sites.

12.29 The level and degree of impact (impact rating) is assigned with reference to a four-point scale as set out in Table 12.2.

Table 12.2: **Criteria for Determining the Magnitude of Impact on Heritage Assets**

Magnitude of Impact	Description of Impact
High	Change such that the significance of the asset is totally altered or destroyed. Comprehensive change to setting affecting

	significance, resulting in a serious loss in our ability to understand and appreciate the asset.
Medium	Change such that the significance of the asset is affected. Noticeably different change to setting affecting significance, resulting in erosion in our ability to understand and appreciate the asset.
Low	Change such that the significance of the asset is slightly affected. Slight change to setting affecting significance resulting in a change in our ability to understand and appreciate the asset.
Negligible	Changes to the asset that hardly affect significance. Minimal change to the setting of an asset that have little effect on significance resulting in no real change in our ability to understand and appreciate the asset.

12.30 An assessment of the significance of effect, having taken into consideration any embedded mitigation, is determined by cross-referencing between the significance (heritage value) of the asset (Table 12.1) and the magnitude of impact (Table 12.2). The resultant significance of effect (Table 12.3) can be adverse or beneficial.

Table 12.3: **Criteria for Determining the Significance of Effect**

	Magnitude of impact			
Significance (heritage value)	**High**	**Medium**	**Low**	**Negligible**
High	Major	Moderate	Minor	Minor
Medium	Moderate	Moderate	Minor	Negligible
Low	Minor	Minor	Negligible	Negligible
Negligible	Minor	Negligible	Negligible	Negligible

12.31 Effects of major or moderate significance are considered to be significant.

12.32 An assessment of the predicted significance of effect is made both prior to the implementation of mitigation and after the implementation of mitigation to identify residual effects. This first highlights where mitigation may be appropriate and then demonstrates the effectiveness of mitigation and provides the framework for the assessment of significance which takes mitigation measures into consideration.

12.33 All archaeological work will be undertaken following the Chartered Institute for Archaeologists (CIfA) 'Standards and Guidance for Historic Environment Desk-Based Assessment' (CIfA, 2017) as well as Historic Environment Scotland guidance.

Potential Significant Effects

12.34 An impact is defined as a change resulting from the Proposed Development on the significance of a cultural heritage resource. During the construction and operation of the Proposed Development the following types of impacts can be anticipated:

- Physical impacts upon archaeological features during construction;

- Impacts upon the setting of heritage assets during construction; and
- Impacts upon the setting of heritage assets during operation.

12.35 No significant effects, resulting from physical impacts, are predicted on the scheduled monument (this was also concluded in the 2016 EIA) within the proposed site boundary due to site design and the consequent positioning of the turbines, access tracks, and other associated infrastructure to avoid these known assets. There is the potential for previously unrecorded archaeological sites to be identified during excavation of access tracks, pads for the turbines, and other associated infrastructure. Should previously unrecorded cup and ring marked stones be identified there is potential that the Proposed Development could have a significant effect on their significance.

12.36 There may also be an impact on the setting of a number of designated assets resulting from the scheme. The Proposed Development will be designed to include embedded mitigation to reduce the impact on the setting of heritage assets where possible. A full assessment will be undertaken to determine the setting of which assets could be impacted. It is not anticipated that any of these impacts will be significant.

Mitigation Measures

12.37 A preliminary review of known heritage assets has been undertaken to inform the development design proposed at Scoping Stage. The exact positions of the turbines, access tracks and associated infrastructure may also be micro-sited, constraints allowing. As the design develops, mitigation measures could include design intervention to avoid physical impacts on known heritage assets. If it is not possible to avoid heritage assets, mitigation could include detailed landscape/topographic survey, archaeological excavation of features being removed and archaeological monitoring/watching brief.

Summary and Conclusions

12.38 This scoping chapter was undertaken using data available from online resources and the previous Clachaig Glen EIA (AECOM 2016). Sixteen designated assets have been recorded within the 1km study area. Furthermore, a number of non-designated assets have also been recorded, including some that are located in the area of the proposed development.

12.39 The number of designated and non-designated heritage assets identified suggest that there is the potential for both physical and setting impacts, however, with the implementation of appropriate mitigation these are not anticipated to be significant. It is noted that this is in line with the 2016 EIA which concluded no significant impacts on cultural heritage was anticipated.

12.40 However, to ensure the potential impacts of the scheme are fully considered a cultural heritage chapter will be completed as part of the EIA process.

References

Ancient Monuments and Archaeological Areas Act 1979.

Argyll and Bute Council and Historic Scotland (n.d.) *Historic Environment Strategy 2015-2020.*

Argyll and Bute Council (2015) *Local Development Plan.*

CIfA (2019) *Code of Conduct Reading: CIfA* https://www.archaeologists.net/sites/default/files/Code%20of%20conduct%20revOct2019.pdf

CIfA (2017) *Standard and Guidance for Historic Environment desk-based Assessment Reading: CIfA* https://www.archaeologists.net/sites/default/files/CIfAS%26GDBA_3.pdf

Historic Environment (Amendment) (Scotland) Act 2011.

Historic Environment Scotland Act 2014.

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

Historic Environment Scotland (2019a) *Historic Environment Policy for Scotland 2019.*

Historic Environment Scotland (2019b) *Historic Environment Scotland Circular: Regulations and Procedures.*

Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997

Scottish Government (2004) *Planning Advice Note 71 – Conservation Area Management.*

Scottish Government (2011) *Planning Advice Note 2/2011: Planning and archaeology.*

Scottish Government (2014a) *Scottish Planning Policy.*

Scottish Government (2014b) *Our Place in Time - The Historic Environment Strategy for Scotland.* https://www.gov.scot/publications/place-time-historic-environment-strategy-scotland/

SNH and HES (2018) *Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland.*

13. Socio-Economics and Tourism

Introduction

13.1 Wind farms have the potential to have both beneficial and negative effects on socio-economics, tourism and recreation. The 2016 EIA did not identify any significant adverse impacts for socio-economics, tourism and recreation as a result of the Consented Development.

13.2 It is not anticipated that the results from the 2016 EIA will change, however, for completeness an EIA chapter with an updated baseline and impact assessment will be provided.

Baseline

Scope of the Assessment

13.3 The assessment has proposed considered the likely effects of the construction, operation and decommissioning of the Proposed Development on:

- Socio-economics - the local communities and associated economies in the vicinity of the Development; and
- Tourism and recreation - tourist/visitor attractions as well as recreational land uses or resources such as visitor centres and walking or cycling routes.

Study Area

13.4 Two study areas have been defined for the assessment and are the same as those defined for the 2016 EIA:

- The study area for socio-economic effects extends to 5 km from the Proposed Development boundary; and
- The study area for tourism and recreation effects extends to 20 km from the Proposed Development boundary in order to ensure consideration of wider amenity issues.

Research into the Effects of Wind Farms on Tourism

13.5 A number of specialist studies and surveys have been undertaken to consider the extent wind farms affect tourism, particularly given the link between the importance of landscape and scenery and certain tourism activities. The following studies were referred to in the 2016 EIA:

- The Economic Impacts of Wind Farms on Scottish Tourism (Glasgow Caledonian University, 2008)
- Wind Farm Consumer Research Topic Paper (VisitScotland, 2011)
- Tourism Impact of Wind Farms (University of Edinburgh, 2012)

13.6 An updated search will be undertaken of recent studies completed assessing the effects wind turbines have on tourism within Scotland.

Methods

Assessment Guidance

13.7 There is no specific guidance directly applicable to the assessment of the socio-economic or tourism effects of onshore wind farms. However, there are a number of other guidance documents which are of relevance. The following have been used to inform the assessment:

- ‘Handbook for EIA’ published by Scottish Natural Heritage in 2018
- Guidelines for Environmental Impact Assessment (IEMA, 2016).

- Volume 11, Section 3, Part 8 of the Design Manual for Roads and Bridges (DMRB): Pedestrians, Cyclists, Equestrians and Community Effects. (The Highways Agency, Scottish Government, Welsh Assembly Government and the Department of Regional Development Northern Ireland, 1993).
- A Good Practice Guide on Planning for Tourism (Department for Communities and Local Government, 2006).

Socio-economics

13.8 The method for the socio-economic assessment has been broadly derived from the DMRB, Volume 11, Environmental Assessment Methodology for the Assessment of Pedestrians, Cyclists and Community Effects (Volume 11, Section 3, and Part 8). This includes consideration of job creation, local expenditure, and potential effects on community facilities. This guidance is used more widely than just on road schemes and is the default UK guidance for all sectors.

Tourism

13.9 The guidance of effects on access and recreation has taken into account Scottish Planning Policy (Scottish Government, 2014a), and broadly follows the guidance contained within DMRB (Volume 11, Section 3, Part 8, Pedestrians, Cyclists, Equestrians and Community Effects). The DMRB guidance recommends considerations of effects on:

- Core paths, footpaths, cycleways and other less formal routes including changes in the amenity of users (walkers, pedestrians, cyclists and equestrians) as well as any severance or disturbance of these as a result of construction, operation and decommissioning of the Development; and
- Recreational or tourist facilities including consideration of potential changes in the amenity value experienced by visitors.

Sensitive Receptors

13.10 The sensitive receptors assessed will be primarily based on those identified in the 2016 EIA, however, an updated assessment will be undertaken to determine additional sensitive receptors to include within the assessment.

Significance Criteria

Sensitivity of Receptors

13.11 Criteria used in this assessment for describing the sensitivity or importance of the receiving environment are summarised in Table 13.1. The sensitivity of the receptor takes in to account the receptor's recognised value or quality in terms of the socio-economic or tourism activities it supports and the ability to absorb an effect without perceptible change. The sensitivity criteria have been derived taking into account relevant legislation, statutory designations or classifications.

Table 13.1: Socio-economic Sensitivity Criteria

Descriptor or Criteria	Description	Examples of receptors
High	The receptor has low capacity to absorb change without fundamentally altering its present character; is of high socio-economic, environmental or tourism value; or of national importance	National Parks, national tourist attractions and destinations; and national cycle routes
Medium	The receptor has moderate capacity to absorb change without significantly altering its present character; has some socio-economic, environmental or	Regional parks, regional tourist attractions; Core paths, long distance paths, regional cycle routes.

	tourism value; or is of regional importance.	
Low	The receptor is tolerant of change without detriment to its character; is of low socioeconomic, environmental or tourism value; or local importance.	Local tourist attractions, local parks, open space and the local core path.
Negligible	The receptor is resistant to change and is of little socioeconomic, environmental or tourism value.	Unmarked footpath or cycleway. No discernible tourism or economic use.

Magnitude of Change

13.12 Criteria for determining the magnitude of potential impacts (magnitude of change) are contained in Table 13.2. The magnitude considers the scale of the predicted changes to existing conditions taking in to account the duration of the impact, the reversibility of the impact and whether the impact is direct or indirect.

Table 13.2: Socio-economic Magnitude Criteria

Magnitude of Change	Description
High	Total loss or major alteration of key elements/ features of the baseline conditions such that post-development character/ composition of baseline condition will be fundamentally changed. • Socio-economic: major long-term (5+ years) alteration of community profile (including community cohesion and stability) and business structure. • Tourism and recreation: Loss or major alteration of iconic tourist asset of national significance, resulting in increase/ reduction in national tourism numbers.
Medium	Loss or alteration of one or more key elements/ features of the baseline conditions such that post-development character/ composition of the baseline condition will be materially changed. • Socio-economic: A noticeable long-term alteration of community profile (including community cohesion and stability) and business structure. • Tourism and recreation: Substantial change to regional tourism numbers. Region considered less/ more attractive place to visit.
Low	Minor shift away from baseline conditions. Changes arising from the alteration will be detectable but not material; the underlying character/ composition of the baseline condition will be similar to the pre-development situation. • Socio-economic: A short-term alteration of community profile (including community cohesion and stability) and business structure. • Tourism: A small and short-term change to regional tourism numbers.
Negligible	Very little change from baseline conditions. Change is barely distinguishable, approximating to a 'no change' situation.

Significance of Effects

13.13 A qualitative approach has been taken to the assessment broadly following the approach illustrated in Table 13.3. The significance of effect is based on a combination of the sensitivity or importance of the receptor and the magnitude of a potential impact. It should be noted that this general approach has been treated as a framework during the assessment and has not been used as a matrix.

13.14 Effects can be adverse or beneficial. The significance of effect (adverse or beneficial) is assessed as Major, Moderate, Minor or Negligible. Effects assessed as Minor or Negligible are considered to be manageable and therefore 'Not Significant'. Effects assessed as Moderate or Major are generally considered to be 'Significant'.

Table 13.3: Significance Criteria

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

Note: shaded boxes typically indicate a likely significant effect.

13.15 The final results of this assessment are presented as residual effects; that is the effect remaining taking in to account the mitigation measures that are incorporated into the design of the Development as well as measures to be implemented during construction, operation and decommissioning. These mitigation measures have been developed based on current good practice and established construction techniques.

Approach to the Assessment

13.16 There is no prescribed methodology or standard guidance for this aspect of the Environmental Impact Assessment (EIA), and so the methodology adopted is one of determining the existing conditions in the locality (baseline) through a desktop analysis, drawing on a range of publicly available statistical information and consultation.

13.17 The potential effects of the Development on the baseline conditions has been assessed using information from sources, including:

- Socio-economics
  - Scottish Government statistic publications;
  - Databases and reports from the Office for National Statistics (ONS); and
  - National Records for Scotland.
- Tourism
  - Transport Scotland annual data;
  - VisitScotland research and statistics reports; and
  - University research papers

Potential Significant Effects

Tourism

13.18 The following potential effects could impact tourism during the construction phase:

- General construction activities including vehicle movements to and from site could result in indirect effects that might deter visitors to the region;
- Increased traffic volumes, noise, dust and the presence of machinery and large vehicles may result in a general reduction in amenity and access; and
- Sensitive tourist routes could be impacted by landscape change during the construction period.

13.19 The following potential effects could impact tourism during the operational phase:

- Landscape and visual changes due to site infrastructure;
- Changes in views from campsites, guest bedrooms and tourist attractions could potentially be perceived to reduce the value of the accommodation and attractions to some tourists; and
- The Proposed Development could change the views along some sections of tourist routes, which may reduce tourist enjoyment of the routes and deter some visitors from using them.

13.20 The following potential effects could impact tourism during the decommissioning phase:

- The effects on tourism during the decommissioning phase are likely to be similar to those during the construction phase.

Socio-economics

13.21 The following socio-economic impacts could occur during the construction phase:

- The Proposed Development would have a beneficial effect on the local economy during the construction phase. This beneficial effect would arise as a result of job creation and local expenditure by the developer and contractors. In order to ensure that the local community benefits from the development of Clachaig Glen Wind Farm, the Applicant intends to establish a community fund following upon award of planning permission.

13.22 The following socio-economic impacts could occur during the operational phase:

- Potential job creation could occur as a result of the Proposed Development and the Applicant is assessing the opportunity to allow the community to invest in the Proposed Development through a Special Purpose Vehicle (SPV).

13.23 The following socio-economic impacts could occur during the decommissioning phase:

- The effects on socio-economics during the decommissioning phase are likely to be similar to those during the construction phase.

Mitigation Measures

Construction

<u>Tourism</u>

13.24 During the construction period traffic flows will vary as different elements of the site are developed and constructed. In order to mitigate against delays and amenity loss associated with construction traffic, a Transport Management Plan (TMP) will be produced during the post-planning stage and approved in consultation with Police Scotland, Argyll and Bute Council and Transport Scotland.

13.25 Public access along the stretch of the Kintyre Way that coincides with the Proposed Development access route is likely to temporarily be restricted during construction to ensure works are carried out safely (e.g. temporarily stopping access during deliveries). The access track will be

partitioned to create temporary footpaths to mitigate against restricted access and to ensure connectivity along the Kintyre Way during the construction period. Signage will be used to raise awareness of construction and promote safe use of alternative routes and temporary footpaths around the Development. The Applicant will provide adequate signage and appropriate advertising of any temporary restrictions to access. Further details will be provided in the TMP to be prepared post consent.

Socio-economic

13.26 A Meet the Buyer Day will be held if planning consent is granted to inform and to open discussions with local business about the opportunities that may exist during construction and operation of the Proposed Development.

Decommissioning

13.27 The potential adverse and beneficial effects that could arise during the decommissioning phase are similar to those identified for the construction phase. For this reason, mitigation measures are also likely to be similar. These will include developing an appropriate TMP to ensure that construction related traffic does not cause unnecessary delays that could deter tourists from coming to or remaining in the area.

Cumulative Effects

13.28 Potential cumulative effects on tourism, recreation and socio-economics may occur with other proposed or consented wind farms in the vicinity of the Development. Cumulative effects will be assessed in individual chapters in the EIA e.g. Chapter 7: Landscape and Visual Impact Assessment and relevant impacts will be presented in Chapter 13 in relation to socio-economics and tourism.

Summary

13.29 This scoping chapter has been prepared utilising data available from online resources and the previous Clachaig Glen 2016 EIA. It is recognised that the 2016 EIA did not identify any significant adverse impacts for socio-economics, tourism and recreation as a result of the Consented Development.

13.30 However, although no adverse significant impacts were identified an updated EIA chapter on socio-economic and tourism is scoped in in order to provide an updated baseline and impact assessment for the Proposed Development.

References

‘Handbook for EIA’ published by Scottish Natural Heritage in 2018

Guidelines for Environmental Impact Assessment (IEMA, 2016).

Volume 11, Section 3, Part 8 of the Design Manual for Roads and Bridges (DMRB): Pedestrians, Cyclists, Equestrians and Community Effects. (The Highways Agency, Scottish Government, Welsh Assembly Government and the Department of Regional Development Northern Ireland, 1993).

A Good Practice Guide on Planning for Tourism (Department for Communities and Local Government, 2006).

14. Traffic, Transport and Access

Introduction

14.1 This chapter considers the potential for impacts of the Proposed Development on traffic and transport. Construction of the Proposed Development is expected to result in the highest volume of traffic generation therefore it is proposed that operational and decommissioning transport impacts are scoped out of the EIA; the justification for scoping out these phases would be further detailed within this chapter.

14.2 There is no published guidance on the assessment of traffic impacts specifically associated with temporary construction activities. However, the methodology detailed in the Chartered Institution of Highways and Transportation (CIHT) 'Guidelines for Traffic Impact Assessments' (1997), recommends that the impact of the traffic generated by a proposed development should be assessed taking cognisance of the Institute of Environmental Assessment (IEA) 'Guidelines for the Environmental Assessment of Road Traffic, 1993' (IEA, 1993). The EIA will therefore follow the methodology set out in the IEA Guidelines as well as utilising professional judgement where necessary.

Baseline Conditions

Study Area

14.3 The Development is situated in a predominantly rural area, situated east of the A83 trunk road (T), 28 km north of Campbeltown. The following roads are included in the study area:

- A83 (T) between Campbeltown and Lochgilphead: This section of the A83 (T) is single carriageway with one lane in each direction. Land use along this stretch of road is primarily agricultural, commercial forestry land with a small number of settlements and pockets of residential properties;
- A83 (T) east of Lochgilphead toward Tarbet: This section of the A83 (T) again is single carriageway with one lane in each direction. Land use along this stretch of road includes commercial forestry and agricultural with a number of settlements and residential properties; and
- A816 (T) between its junction with the A83 (T) at Lochgilphead north towards Oban: This section of the A816 (T) is single carriageway with one lane in each direction. Land use along this stretch of road includes commercial forestry and agricultural land with a small number of settlements and residential properties.

Abnormal Load Route

14.4 The preferred route for delivery of turbine equipment to the Site is from the harbour at Campbeltown. The route from the harbour to the A83 (T) would involve egressing the harbour onto Kinloch Road travelling northwest along Aqualibrium Avenue, then turning right onto the A83 (T). From Campbeltown the abnormal load route to site would be along the A83 (T) northwards approximately 28km to Killean where an overrun area would be provided on existing 3rd party land to the west of the A83 (T) to assist with the right turn manoeuvre required. The proposed access route to the site extends from the A83 (T) through "Killean Forest" to the site utilising an existing Unclassified Road. The redline boundary of the site extends to a 10m buffer around the existing Unclassified Road from the A83 (T) to site to accommodate localised widening to support abnormal and construction traffic access. Within the site a series of access tracks would be provided.

14.5 An access assessment of the abnormal load route from harbour to site has been undertaken by AECOM in 2020. This includes a swept path analysis (SPA) of the route from Campbeltown to Killean using a 67.2m blade as part of the assessment of the route for RWE's Eredine project, which is located further north in Argyll. Given the increased rotor diameter (140m max) proposed for Clachaig Glen as part of the current application, SPA showing a vehicle carrying a Vestas

V136 for the remainder of the route through Killean Forrest would be included as a Technical Appendix to the EIA Report.

Construction Traffic Route

14.6 The volume of construction traffic will largely be influenced by whether the required material can be 'won' onsite using the proposed temporary quarries (or 'borrow pits').

14.7 The traffic assessment will conservatively assume that all construction material will be imported to the Site as a worst case scenario; the use of the temporary quarries on site would therefore serve to reduce the associated traffic numbers.

14.8 There are at least three potential offsite quarry locations where construction materials (such as aggregate and ready mixed concrete) could be sourced from. The locations of these offsite quarries and the routes that HGVs would take between to the Site, are:

- Oban, 85 km north: (there are a number of quarries near Oban): Route to the Development would include the A816 (T) from Oban and then the A83 (T);
- Furnace, 62 km northeast: Route to the Development would include the A83 (T) South from Furnace; and
- Cairndow, 80 km northeast: Route to the Development would include the A83 (T) south from Cairndow.

14.1 It should be noted that the above list is not exhaustive and considers only a selection of the main quarry operators. There may be smaller local suppliers who could also be used during the construction phase. Furthermore, it is also noted that other construction materials, deliveries and site staff would likely originate from neighbouring towns to the site.

Methods

Traffic Counts

14.2 Traffic counts would be obtained from the Department for Traffic (DfT) records of publicly available Annual Average Daily Traffic Flows. A list of traffic count locations from the DfT records is demonstrated in Table 14.1 along with the most recent results available for all counters (2017) covering the study area, namely the A83 (T) and the A816 (T). Background traffic flows are predicted to increase on the local road network regardless of the Proposed Development. This assumption is based on the forecast growth in the volume of traffic as described in National Road Traffic Forecasts (Great Britain) (NRTF). Therefore, future design year traffic flows would be forecast utilising National Road Traffic Forecast (NRTF) 'low' growth assumptions. 'Low growth' is used as this demonstrates the most robust impact caused by development trips when these are applied to the study network.

Table 14.1: DfT Traffic Count Locations and Baseline Results

Average annual daily traffic flows (AADF) 2017

Link Relating to Count Point	Road	Count Point	M/C	Car	Bus	LGV	HGV	Total Vehs
Campbeltown to site	A83 (T)	40845	19	1529	68	505	176	2297
Site to Lochgilphead	A83 (T)	77107	0	1435	42	551	218	2246
Site to Lochgilphead	A83 (T)	80363	19	1892	34	674	263	2881
Lochgilphead to Tarbet (A82)	A83 (T)	40767	75	3912	91	842	365	5285
Lochgilphead to Tarbet (A82)	A83 (T)	50771	122	4635	226	710	419	6111

Lochgilphead to Oban	A816 (T)	30797	19	1564	12	379	151	2124
Lochgilphead to Oban	A816 (T)	792	36	1130	15	271	89	1540
Lochgilphead to Oban	A816 (T)	40794	15	1950	48	487	159	2660

Source: DfT Traffic Counts (https://roadtraffic.dft.gov.uk/#11/56.1968/-4.9813/basemap-localauthorities-countpoints)

Receptors

14.3 Receptors are locations or land uses categorised by their degree of sensitivity (or environmental value) with guidance provided in the Design Manual for Roads and Bridges (DMRB), LA 104 Revision 1, "Environmental Assessment and Monitoring." Receptors that will be considered in the traffic and transport assessment are locations or land uses categorised by their degree of sensitivity (or environmental value) with guidance provided in the Design Manual for Roads and Bridges (DMRB), LA 104 Revision 1, "Environmental Assessment and Monitoring."

14.4 Table 14.2 provides criteria used in this assessment to quantify the sensitivity of the receptors to the effect of the predicted traffic associated with the Proposed Development.

Table 14.2: Sensitivity of Traffic and Transport Receptors

Sensitivity	Receptor Description
Very High	Nationally or internationally important site with special sensitivity to increases in road traffic.
High	Regionally important site with special sensitivity to increases in road traffic.
Medium	Residential (with frontage onto road under consideration), educational, healthcare, leisure, public open space or town centre/local centre land use.
Low	Employment or out of town retail land use, such as retail park.
Negligible	No adjacent settlements.

Source: DMRB (Note: DMRB Guidance utilises a 5 step sensitivity scale which will be utilised in the EIA)

14.5 In terms of magnitude of effect (or magnitude of change), the IEA Guidelines point to changes (increases) in traffic in excess of 30%, 60% and 90% as being representative of 'Slight', 'Moderate' and 'Substantial' impacts respectively. The categories shown in Table 14.3 reflect IEA Guidelines and have been used in this assessment to quantify the magnitude of effect of the predicted traffic associated with the Proposed Development.

Table 14.3: Magnitude of Change for Traffic and Transport

Magnitude	Description
High	Considerable deterioration/improvement in local conditions or circumstances (+90% increase in traffic)
Medium	Readily apparent change in conditions or circumstances (60 – 90% increase in traffic)
Low	Perceptible change in conditions or circumstances (30 – 60% increase in traffic)
Negligible	Very small change in conditions or circumstances (Under – 30% increase in traffic)

Source: IEA. (1993). Guidelines for the Environmental Assessment of Road Traffic.

Defining Significance

14.6 Criteria are applied to the percentage increases to establish whether significant environmental effects are likely. These criteria take into account the sensitivity of the receptors or the resources likely to be affected and any changes in the composition of traffic, specifically if more Heavy Goods Vehicles (HGVs) are anticipated. The criteria are a 30% or more increase in total

movements or of HGVs, or a 10% increase where sensitive locations, such as schools, are present.

14.7 The significance of each impact is considered against the criteria within the Institute of IEA Guidelines, where possible. However, the IEA guidelines state that:

> *"For many effects there are no simple rules or formulae which define the thresholds of significance and there is, therefore, a need for interpretation and judgement on the part of the assessor, backed-up by data or quantified information wherever possible. Such judgements will include the assessment of the numbers of people experiencing a change in environmental impact as well as the assessment of the damage to various natural resources."*

14.8 The assessment of the significance of the effect of traffic changes along the identified study network as a result of the Proposed Development should have regard to both the magnitude of the traffic increase (change) and the receptors environmental value (sensitivity). The level of significance can be determined from the matrix in Table 14.4 (based upon the guidance given in HA 205/08).

Table 14.4: Significance of Effects

Magnitude of Change	Sensitivity or value of resource / receptor				
	Very High	High	Medium	Low	Negligible
High	Major	Major	Moderate	Moderate	Minor
Medium	Major	Moderate	Moderate	Minor	Negligible
Low	Moderate	Moderate	Minor	Negligible	Negligible
Negligible	Minor	Minor	Negligible	Negligible	Negligible

Source: DMRB

14.9 These criteria are subjective but take into account the number of receptors affected, their sensitivity and the length of the period for which they will be impacted. Mitigation, where appropriate, will be identified and incorporated into the construction planning and design of the Proposed Development.

Potential Significant Effects

14.10 The potential effects as listed in the IEA Guidelines are as follows:

- Noise and Vibration (this is considered in Chapter 8);
- Visual impact (this is considered in Chapter 7);
- Severance (for motorists or pedestrians);
- Increased journey times for non-construction traffic;
- Pedestrian delay, intimidation, loss of amenity;
- Road accidents and safety;
- Hazardous loads (not considered as no hazardous substances will be transported to the site);
- Air quality;
- Dust and dirt;
- Ecological impact (this is considered in Chapter 9); and
- Heritage and conservation areas (this is considered in Chapter 12).

14.11 It is likely that the main transport impacts will be associated with the movements of HGVs and Large Goods Vehicle (LGVs) travelling to and from the Proposed Development site as well as vehicles associated with construction staff.

Aspects to be Scoped Out

14.12 Once the Development is operational, it is envisaged that the amount of traffic associated with operation will be minimal (restricted to occasional service vehicles such as 4x4s with occasional need for larger vehicles). Decommissioning will more closely follow the construction impact though without the need for abnormal loads as turbine components can be deconstructed on site into smaller sections. Therefore, it is not proposed to undertake any detailed assessment of the operational or decommissioning phase as part of the EIA.

Mitigation Measures

14.13 A Construction Traffic Management Plan (CTMP) will be developed in consultation with ABC, Transport Scotland (as necessary), Police Scotland and other stakeholders following award of consent and as required under the consented scheme. Likely topics to be included in a CTMP would include, but not limited to, the following:

- The agreed route for construction traffic including any abnormal loads;
- The necessary agreements and timing restrictions for construction traffic, for example Monday – Friday working only, prohibition during school drop-off and pick-up times, and prohibition during loading times at commercial premises;
- Details of a proposed condition survey on access routes;
- Proposals for maintenance of the agreed routes for the duration of the construction phase;
- Proposals for monitoring and agreeing maintenance costs;
- Escort arrangements for abnormal loads;
- Route signing;
- Maintaining access to commercial / business premises. For example, temporary accommodation works and additional information signing;
- Details of the advanced notification to the general public warning of any construction transport movements, specifically abnormal loads;
- Details of information road signage warning road users of forthcoming abnormal load transport and construction traffic movements;
- Arrangements for regular road maintenance and cleaning, e.g. road sweeping in the vicinity of the site access point as necessary, wheel cleaning / dirt control arrangements;
- Contractor speed limits; and
- Community and emergency services liaison details.

14.14 The hours for which construction can take place, and therefore the hours for which construction traffic will be travelling to and from the Proposed Development site, will be agreed with relevant parties before construction commences.

14.15 At the turn off the A83 (T) at Killean, access signs will be present warning vehicles of an increased risk of construction traffic in accordance with the proposals within the agreed CTMP. A proposed overrun area to the west of the A83 (T) to assist with the right turn manoeuvre to Killean Forrest is included in the scheme. This would have capacity to hold vehicles allowing any build-up of traffic behind the delivery convoy to pass before the turn is made.

14.16 Wheel cleaning facilities will be present on the Proposed Development site to prevent the depositing of dirt onto the local road network. Arrangements for road sweeping will be in place as required. Loads that may produce excessive dust during transport will be covered.

Summary and Conclusions

14.17 The proposed study network would cover an extensive network of roads providing potential access routes to the Proposed Development site. These being:

- A83 (T) between Campbeltown and Lochgilphead: This section of the A83(T) is single carriageway with one lane in each direction. Land use along this stretch of road is primarily agricultural, commercial forestry land with a number of residential properties.

14.18 The assessment will provide details of the proposed access route from the principal road, point of access to the Proposed Development site at Killean Forrest and an indication of the likely number of vehicle movements and further details on mitigation measures, such as a Construction Traffic Management Plan, required during the process.

14.19 The EIA Report will assess the potential effects on local roads due to construction traffic. There are very few operational and decommissioning traffic movements so it is proposed to scope out the effects of these traffic movements.

References

IHT. (1994). Guidelines for Traffic Impact Assessment.

IEA. (1993). Guidelines for the Environmental Assessment of Road Traffic.

DETR. (1997). National Road Traffic Forecasts (Great Britain) 1997.

DMRB. (2008). HA205/08 Assessment and Management of Environmental Effects. Volume 11 Section 2 Part 5.

15. Infrastructure and Telecommunications

Introduction

15.1 Wind turbines can affect communication systems that utilise electromagnetic waves as their means of transmission. It is therefore necessary to ensure turbines are separated from telecommunications links by suitable distances to avoid interference. Utilities infrastructure (such as gas pipelines and overhead cables) also needs to be considered to ensure the Proposed Development does not have a significant effect on this infrastructure.

Baseline Conditions

15.2 Consultation was undertaken for the 2016 EIA with the Office of Communication (OFCOM) and relevant operators to identify the location of infrastructure assets and telecommunication links that may be affected by the Consented Development and to confirm the extent of the required separation distances between the turbines and identified interests.

15.3 The initial OFCOM consultation identified a number of links that intersect the proposed Site or are within the vicinity of the Consented Development. The service providers of these links are as follows:

- The Office of Communication (OFCOM);
- Vodafone;
- Atkins Ltd;
- Joint Radio Company (JRC);
- Scottish Water Telemetry;
- British Telecom;
- CSS Spectrum Management Services Ltd;
- Arqiva;
- Scottish and Southern Energy (SSE);
- Scotland Gas Networks; and
- Scottish Water.

15.4 These service providers were contacted directly, and their responses are documented below in Table 15.1.

Table 15.1: Service Providers

Service Provider	Date Response Received	Response
OFCOM	05/03/2015	Recommend contacting Vodafone, Atkins and JRC.
Vodafone	15/12/2015	No objection to the Development.
Atkins Ltd	07/12/2015	The application has been examined in relation to UHF Radio Scanning Telemetry communications used by our Client in that region and we are happy to inform you that we have no objection to the proposal. Please note that this is not in relation to any Microwave Links operated by Scottish Water.
Joint Radio Company (JRC)	06/04/2016	After an initial objection, further consultation was undertaken with JRC to assess the proposed turbine locations of the final layout. The proposal

		was cleared with respect to radio link infrastructure operated by the local electricity utility and Scotia Gas Networks.
Scottish Water Telemetry	N/A	A response from Scottish Water Telemetry was not received. These were not originally recommended to be contacted by OFCOM, but a consultation was undertaken anyway following the Atkins Ltd. response.
British Telecom	08/02/2015	We have studied this wind farm proposal with respect to EMC and related problems to BT point-to-point microwave radio links. The conclusion is that the project should not cause interference to BT's current and presently planned radio networks.
CSS Spectrum Management Services Ltd	N/A	A response from CSS Spectrum Management Services Ltd. was not received. It was recommended in the 2013 Scoping Response that they were contacted separately to the OFCOM consultation. Contact details were provided in the 2013 Scoping Response and used for the consultation.
Arqiva	N/A	A response from Arqiva was not received.
Scottish and Southern Energy Plc (SSE)	09/01/2014	A number of 6.6/11kV overhead cables have been identified within the vicinity of the Development, one of which intersects the Development boundary at the site entrance.
Scotland Gas Networks	13/01/2014	Records show that there are no gas mains in the area of the Development.
Scottish Water	22/01/2014	A number of water assets have been identified within the vicinity of the Development. An isolated water main intersects the western side of the Development.

15.5 Details of all infrastructure and telecommunication assets are displayed on Figure 15.1, with the appropriate standoff distances applied.

15.6 Further consultation, using the new proposed turbine dimensions and positions, will be undertaken with OFCOM for the newly Proposed Development to identify any changes to the links mentioned above. Service providers will be contacted as a result of this consultation.

15.7 A desk-based assessment has identified that no gas pipelines or electricity transmission lines are located within the vicinity of the proposed turbine positions. Further consultation will be undertaken with various infrastructure service providers to identify any assets that may be affected by the Proposed Development.

Methods

15.8 AECOM has initiated consultation with OFCOM to identify any links which could potentially affect the proposed Site and proposed layout. This is because turbines have the potential to interfere with the operations of telecommunication equipment and it is necessary to design the wind farm to minimise the effects on this equipment or seek appropriate mitigation.

15.9 AECOM will continue this consultation, using the new proposed turbine dimensions and positions, and re-consult with OFCOM regarding telecommunication links and infrastructure. The results of the consultation will be used to demonstrate that the site design process has been completed to ensure that the wind farm has no detrimental effect on the infrastructure.

15.10 The Infrastructure and Telecommunications EIA Report chapter will detail consultation with the various parties and confirm mitigation measures should they be necessary.

15.11 For electromagnetic interference, assessment of the Proposed Development will be based upon whether there is a direct interference. Since this effect is either present or absent it is not considered appropriate to define sensitivity or the magnitude of change in respect of these effects. Rather, it is considered that if an effect is present, then it will be deemed to be Significant and, if the effect is absent, then it will be deemed to be Not Significant.

Potential Significant Effects

15.12 There are unlikely to be any significant effects related to infrastructure and telecommunications due to the separation distance of the proposed turbine positions and the infrastructure assets.

Mitigation Measures

15.13 Should a significant effect be identified, further consultation to agree an appropriate measure to mitigate the effect to provide an insignificant residual impact will be undertaken.

Summary and Conclusions

15.14 A number of telecommunication links and infrastructure assets have been identified in the vicinity of the Proposed Development, some of which lie within the Proposed Development boundary. The proposed wind turbines and the meteorological mast have been sited away from these assets at distances well in excess of required separation/ clearance distances; therefore, no significant effects are predicted to occur on infrastructure and telecommunications. It is noted that the 2016 EIA concluded that no significant effects are predicted to occur on infrastructure and telecommunications.

15.15 Further consultation with the service providers will need to be conducted using the new proposed turbine dimensions and positions to finalise and eliminate any potential effect on these links, and as such Infrastructure and Telecommunications is scoped into the EIA.

16. Air Safeguarding

Introduction

16.1 This chapter has been prepared by Wind Power Aviation Consultants Limited (WPAC Ltd).

16.2 The Site is located in an area that is relatively remote from significant aviation features as shown in Figure 16.1. It is located under unregulated airspace and a significant distance from any large commercial airports or military aviation facilities; however, this chapter explains the methodology used to undertake the aviation safeguarding scoping assessment, lists the aviation references used and describes the aviation baseline conditions, consultation requirements and mitigations to be applied if required.

16.3 The following documents are referenced in this assessment:

A. Civil Aviation Publication (CAP) 764 Civil Aviation Authority (CAA) Policy and Guidance on Wind Turbines Version 6, Feb 2016

B. CAP 168 Licensing of Aerodromes, Version 10 March 2014

C. CAP 670 ATS Safety Requirements Version 3 May 2014

D. CAP 774 UK Flight Information Services, Ed 2.3 Feb 2015

E. CAP 738 Safeguarding of Aerodromes Version 2 Dec 2006

F. CAP 793 Safe Operating Practices at Unlicensed Aerodromes Ed 1 July 2010

G. CAP 493 Manual of Air Traffic Services Part 1 Ed 6.1 April 2015

H. CAP 660 Parachuting Ed 4 July 2008

I. Military Aviation Authority Regulatory Article 2330 (Low Flying)

J. UK Military Aeronautical Information Publication (MIL AIP)

K. UK Aeronautical Information Publications (AIP)

L. CAA 1:250,000 and 1:500,000 VFR Charts

Assessment Criteria and Methodology

16.4 Wind turbines have the potential to affect civil and military aviation operations. The assessment of effects of the proposed turbines will be based upon the guidance laid down in CAA Publication CAP 764 *Policy and Guidelines on Wind Turbines* Version 6 Dated February 2016. Consultation criteria for aviation stakeholders is defined below. These distances inform the size of the search area and include:

- Airfield with a surveillance radar – 30 km
- Non radar licensed aerodrome with a runway of more than 1,100 metres – 17 km
- Non radar licensed aerodrome with a runway of less than 1,100 metres – 5 km
- Licensed aerodromes where the turbines would lie within airspace coincidental with any published Instrument Flight Procedure (IFP)
- Unlicensed aerodromes with runways of more than 800 metres – 4 km
- Unlicensed aerodromes with runways of less than 800 metres – 3 km
- Gliding sites – 10km
- Other aviation activity such as parachute sites and microlight sites within 3 km – in such instances developers are referred to appropriate organisations

16.5 CAP 764 goes on to state that these distances are for guidance purposes only and do not represent ranges beyond which all wind turbine developments will be approved or within which they will always be objected to. These ranges are intended as a prompt for further discussion between developers and aviation stakeholders and will be reported upon in the EIA.

16.6 It is necessary to take into account the aviation and air defence activities of the Ministry of Defence (MOD) as safeguarded by the Defence Infrastructure Organisation (DIO). The types of issues that will be addressed in the EIA include:

- Ministry of Defence Airfields, both radar and non-radar equipped
- Ministry of Defence Air Defence Radars
- Ministry of Defence Meteorological Radars
- Military Low Flying

16.7 It is necessary to take into account the possible effects of wind turbines upon the National Air Traffic Services En Route Ltd (NERL) communications, navigation and surveillance systems – a network of primary and secondary radars and navigation facilities around the country.

16.8 As well as examining the technical impact of wind turbines on Air Traffic Control (ATC) facilities, it is also necessary to consider the physical safeguarding of ATC operations using the criteria laid down in CAP 168 *Licensing of Aerodromes* to determine whether a proposed development will breach obstacle clearance criteria. This will also be reported on in the EIA, but initial surveys show there are no physical safeguarding issues associated with the Proposed Development.

Radar Modelling Methodology

16.9 The radar calculation results shown in this report have been produced using specialist propagation prediction software (Rview Version 5). Developed over a number of years, it has been designed and refined specifically for the task. RView uses a comprehensive systems database which incorporates the safeguarding criteria for a wide range of radar and radio navigation systems. RView models terrain using the latest Ordnance Survey (OS) Terrain 50 digital terrain model, which has a post spacing of 50m and has a root mean square (RMS) error of 4m. The results are verified using the Shuttle Radar Topography Mission (SRTM) dataset, a separate smoothed digital terrain model with data spacing of 3 arc seconds. By using two separate and independently generated digital terrain models, anomalies are identified and consistent results assured. Rview models the refractive effects of the atmosphere on radio waves and the First Fresnel Zone. A feature of RView is that as well as performing calculations in the manner believed to be most appropriate it also allows comparison with results from simpler models. For example, RView can perform calculations using the true Earth Radius at the midpoint between the radar and the wind turbine or the simplified 4/3 Earth Radius model. If needed, Rview is also capable of modelling a range of atmospheric refractive conditions. RView models the trajectory of radar signals at different elevations enabling modelling of both volume surveillance and pencil beam radars as well as the effects of angular sterilisation as applied, for example, in Met Office radars.

Licensed Aerodromes

16.10 An initial review undertaken by Wind Power Aviation Consultants Ltd (WPAC) using the above criteria shows that there are no civil licensed radar equipped aerodromes within 30km, however, the closest is at Glasgow Prestwick Airport (GPA), 67km to the east. Radar line of sight (RLOS) modelling has been undertaken against the GPA radar with the results in Table 16.1 below. The results show that none of the turbines will be visible to the radar and consultation is not required.

Table 16.1: Radar Line of Sight (RLOS) Results Glasgow Prestwick Radar (metres above ground level)

Turbine	RLOS	Turbine	RLOS	Turbine	RLOS
T1	377.8	T5	376	T10	544.8
T2	341.5	T6	397.7	T11	542.1
T3	410.2	T7	435	T13	522.5
T4	459.7	T8	437.5	T14	576.8

16.11 There are no non-radar equipped licensed aerodromes within 17km, however, the closest is at Campbeltown, 20km to the south. Although beyond standard consultation and safeguarding distance, it would be prudent to consult with Highlands and Islands Airports Ltd (HIAL) to confirm their position and build on the work conducted for the original wind farm scheme. This will be undertaken and reported in the EIA.

Unlicensed Aerodromes

16.12 There are no known unlicensed aerodromes within consultation distance. The closest facility of interest is the private airstrip on Gigha, over 9km to the north-west. There is no requirement to consult with the operator of Gigha airstrip.

16.13 An online search for private airfields has been conducted and none identified within consultation distance, however, not all private strips are listed in publications or marked on charts. Operators of any such private airstrips that are identified during EIA preparation will be consulted in accordance with CAP 764 and CAP 793 Safe Operating Practices at Unlicensed Aerodromes

Ministry of Defence (MOD)

16.14 **ATC Radars** - the closest Ministry of Defence (MOD) radar equipped airfield is at the dormant airfield at West Freugh, 90km to the south. The radar is used mainly for range control in Luce Bay and the approaches. For completeness radar modelling has been undertaken with the results at Table 16.2. It is clear that there is no possibility of the proposed development affecting the West Freugh radar and there will be no MOD ATC radar objection. The MOD will be consulted to confirm their position and their response reflected in the EIA.

Table 16.2: Radar Line of Sight (RLOS) Results MOD West Freugh PSR

Turbine	RLOS	Turbine	RLOS	Turbine	RLOS
T1	469.8	T5	470.8	T10	591.6
T2	477.6	T6	491	T11	634.3
T3	493.6	T7	490.7	T13	534.4
T4	547.1	T8	576.5	T14	608.1

16.15 **Air Defence Radar** – there are no affected air defence radars. Radar modelling has been undertaken which shows that the closest radar is at Benbecula, North Uist, over 250km to the north. It will not be affected as the turbines are all screened by terrain and earth curvature.

16.16 **MOD Low Flying** – The proposed development is located within a blue area on the MOD wind farm low flying consultation charts. A blue area is defined as a "*low priority military low flying area less likely to raise concern*" and an objection is unlikely.

NATS En Route Ltd (NERL)

16.17 The closest NERL radars are at Lowther Hill and Tiree. Initial radar modelling by WPAC indicates that the Proposed Development will have no effect on Tiree which is 120km to the north-west and completely screened by Jura. Radar modelling for Lowther Hill has been undertaken with the results in Table 16.3.

Table 16.3: Radar Line of Sight Results Lowther Hill Radar

Turbine	RLOS	Turbine	RLOS	Turbine	RLOS
T1	183.2	T5	153.2	T10	353.2
T2	153.9	T6	251.5	T11	366.1
T3	180.1	T7	250	T13	327.9
T4	251.5	T8	319.3	T14	362

16.18 The results show that two of the turbines will be in theoretical line of sight from the Lowther Hill radar. It will be necessary to consult with NERL and the results of the consultation will be included in the EIA.

Met Office Radars

16.19 The Met Office safeguards its network of radars using a European methodology known as OPERA. In general, they will object to any turbine within 5 km in line of sight and will examine the impact of any turbines within 20 km. Where a site is within 20 km, the Met Office will undertake an operational assessment based on three main criteria, having determined that there is a technical impact on the radar. The factors they will consider include the following:

- Proximity to Airports
- River catchment response times
- Population density

16.20 In this case the closest Met Office radar is Holehead, over 80km to the north-east and well beyond 20km. There is unlikely to be a Met Office radar objection to this proposal, this will be confirmed through consultation and reported in the EIA.

Consultation

16.21 Consultation with relevant aviation providers is a routine part of wind farm development and in accordance with CAP 764 consultees will include:

- MOD DIO
- NERL
- HIAL (Campbeltown Airport)

Aviation Obstruction Lighting

16.22 CAA extant lighting policy is covered in Reference M; it states that any obstruction in excess of 150m above ground level constitutes an '*en route navigation hazard*'. Wind turbines are lit with medium intensity (2000 candela) fixed red lights located on the highest practical point, in this case the nacelle. There is also currently a requirement for 32 candela lights halfway down the tower. There are a number of mitigations that can be applied to minimise the effect of lighting on the surrounding area including reducing the number of turbines that need to be lit, reducing the brilliance of the lights to a minimum of 10% when the visibility in all directions exceeds 5km and designing the lights to minimise downwards illumination. The CAA have recently released a draft change to the lighting requirements which is expected to be ratified shortly. A full lighting assessment will be undertaken for inclusion as an appendix within the EIA.

Conclusion

16.23 As a result of the above assessment and need to consult with the specified stakeholders Air Safeguarding is scoped into the EIA.

17. Forestry

Introduction

17.1 This chapter has been prepared by Wood Group Limited. This chapter follows a different structure than previous chapters due to the specific nature of the assessment methodology proposed.

17.2 The Proposed Development lies within land owned by Forestry & Land Scotland (FLS). Carradale Land Management Plan (LMP) covers an area of 6704.3 hectares on the eastern coast of the Kintyre peninsula in Argyll & Bute. The plan area comprises four forest areas: Deer Hill, Deucheran, Grogport and High Clachaig. The Proposed Development lies in the latter area. The LMP is currently being revised and the new plan is scheduled to go out to consultation in July 2020 and be adopted later in the year. It will set out details of the forest area together with the management objectives and activities for the years 2020-29. The forest is primarily managed for commercial timber production whilst also delivering a range of ecosystem services, including peat restoration. A further objective is to support renewables energy developments to help fit them to the landscape and be integrated with other land management objectives. The land contains a variety of different habitats, from conifer forest to native broadleaf areas and peat bogs. It is rich in biodiversity, sustaining different habitats and plant/animal species. The LMP area contributes significantly to meeting FLS timber production targets. The forest has been extensively restructured over recent years and carries a diverse range of age classes.

17.3 It is intended that the forestry impacts of the Proposed Development will be addressed in the development of a Wind Farm Forest Design Plan (WFFDP). This will comprise a uniquely holistic approach to the development of the forestry aspects of the EIA. This approach will be focussed on maximising the sustainable resource outputs of the Proposed Development as a whole with the primary aim of optimising turbine performance and minimising forest removal whilst recognising the commercial and non-market objectives of the forest owner. The proposed WFFDP will take into account the Scottish Government's Control of Woodland Removal Policy, the UK Forest Standard and other relevant regulations and guidelines.

17.4 This will involve a twin track approach with felling to allow keyholing of wind turbines and associated infrastructure (roads, cable routes etc.) being addressed in the EIA. In parallel, discussions have already been initiated with FLS, as part of the consultation associated with the development of the new LMP noted above to consider options for the prioritising of felling those areas which would facilitate efficient development, construction and operation of the wind farm. It should be noted that it is anticipated that no pre-mature felling will be proposed with only areas scheduled to be felled for timber production within the existing LMP being considered for felling.

17.5 The WFFDP will be a combination of the outputs from the EIA process and the result of collaboration with FLS on the development of the new LMP.

Conclusion

17.6 As a result of the above assessment and identification of relevant stakeholders Forestry is scoped into the EIA.

18. Shadow Flicker

Introduction

18.1 Shadow flicker has rarely been a problem with wind energy developments although it is accepted that it can, on occasion, present a nuisance to amenity when people are within the rooms affected by the phenomenon.

Baseline Conditions

18.2 Properties are present along the west of the proposed Site. Shadow flicker effects have been proven to only occur within ten rotor diameters of a turbine and only properties within 130° either side of north, relative to the turbines can be affected.

18.3 The assessment study area was defined as the area over which shadow flicker effects could affect properties (i.e. within 10 rotor diameters of each turbine). Given the parameters of the Proposed Development described in Chapter 3: Project Description, a buffer radius of 1,450 m was applied to each turbine location to determine the overall study area, which is shown on Figure 18.1. This is based on a maximum 140m rotor width plus a 50m proposed micro-siting allowance.

18.4 A single property, known as High Clachaig, is located within the study area, 0.5 km southwest of the Proposed Development and within 1220m of the closest turbine (Turbine 14). A site visit was undertaken on 21 December 2015 to determine the location of windows at the High Clachaig residential property. It was confirmed that none of the windows of this property face the direction of the wind farm, however a shadow flicker assessment will still be undertaken.

18.5 The proposed turbines are located approximately 1.1 km from the nearest core path/cycle route. As the Proposed Development's proposed blade tip height is a maximum of 180 m, the turbines are therefore located well in excess of the 3 times blade tip height (540m) separation distance recommended by the British Horse Society to avoid distress to horses from shadow flicker (BHS, 2014). The effect on pedestrians and horse riders has therefore not been considered further and is expected to be negligible.

Methods

18.6 Whilst there is no specific standard for the assessment of shadow flicker in the UK and no guidelines on acceptable levels of shadow flicker, planning guidance is contained within the Scottish Government Specific Advice Sheet for Onshore Wind Turbines. On page 6, the advice sheet states:

> *"Under certain combinations of geographical position, time of day and time of year, the sun may pass behind the rotor and cast a shadow over neighbouring properties. When the blades rotate, the shadow flicks on and off; the effect is known as "shadow flicker". It occurs only within buildings where the flicker appears through a narrow window opening. The seasonal duration of this effect can be calculated from the geometry of the machine and the latitude of the potential site.*
> *Where this could be a problem, developers should provide calculations to quantify the effect. In most cases however, where separation is provided between wind turbines and nearby dwellings (as a general rule 10 rotor diameters), "shadow flicker" should not be a problem. However, there is scope to vary layout/reduce the height of turbines in extreme cases."*

18.7 The aim of this section of the EIA will therefore be to quantify the predicted level of shadow flicker that could potentially be experienced by affected dwellings (within 10 rotor diameters of a turbine).

18.8 Specialist software 'Wind Pro' will be used to quantify the extent of shadow flicker that could occur within the study area. This model accounts for latitude and longitude of the Proposed Development and uses a model of the sun's position in the sky throughout the year to calculate shadow lengths, positions and times. A Digital Terrain Model (DTM) was also used in the assessment to take account of the topography between receptors and turbines.

18.9 There are currently no UK guidelines which quantify what exposure levels of shadow flicker are acceptable, however, Predac, an EU sponsored organisation that promotes best practice in energy use and supply, suggests that a maximum of 30 hours of shadow flicker in any calendar year is acceptable for properties within 500m of a turbine position (Predac, 2004). Effects are considered significant if the amount of predicted shadow flicker exceeds this valuewithin a distance of 500m.

Potential Significant Effects

18.10 During the operation of the Proposed Development there is unlikely to be any significant effects related to shadow flicker. This is due to the layout design which has already taken into account the setback distances required to avoid significant effects and the orientation of the windows identified at the nearest property which face away from the Proposed Development.

Mitigation Measures

18.11 Should a potential significant effect be identified, further consultation to agree an appropriate measure to mitigate the effect to provide an insignificant residual impact will be undertaken. The layout of the turbines can minimise the potential effects from shadow flicker on the properties. The assessment will be based on quantifying the potential amount of shadow flicker and will detail a range of mitigation measures that can be implemented to reduce the occurrence of shadow flicker, if required.

Summary and Conclusions

18.12 There is one property that has the potential to be affected by shadow flicker due to its proximity to the proposed development. The orientation of the windows at this dwelling means no adverse significant effects are anticipated from shadow flicker. It is noted that the 2016 EIA concluded that no adverse significant effects were anticipated from shadow flicker.

18.13 However, due to a proposed change in onsite turbines a shadow flicker assessment is scoped into the EIA.

References

British Horse Society: BHS (2014). Advice on Wind Turbines and Horses – Guidance for Planners and Developers.

Department of Energy and Climate Change (2011). Update of UK Shadow Flicker Evidence Base.

Scottish Government (Updated 2014). Online Renewables Planning Advice: Onshore Wind Turbines. Accessed on 17 June 2020 https://www.gov.scot/publications/onshore-wind-turbines-planning-advice/

Predac (2004). Spatial Planning of Wind Turbines.

19. Major Accidents and Disasters (including Climate Change)

19.1 None of the following climate trends identified in UKCP0913[10] could affect the Proposed Development with the exception of increased windstorms:

- Increased temperature;
- Changes in the frequency, intensity and distribution of rainfall events (e.g. an increase in the contribution to winter rainfall from heavy precipitation events and decreases in summer rainfall);
- Increased windstorms; and
- Sea level rise.

19.2 Braking mechanisms installed on turbines allow them to be operated only under specific wind speeds and should severe windstorms be experienced, then the turbines would be shut down. In addition, given the elevated location of the project area, flooding will not pose a significant risk to the operation of the wind farm nor will the construction of the proposed development contribute to flooding elsewhere.

19.3 The potential for ice throw to occur after turbine start up following a shut down during conditions suitable for ice formation is high. There are monitoring systems and protocols in place to ensure that turbines that have been stationary during icing conditions are restarted in a controlled manner to ensure public safety. The risk to public safety is considered to be very low due to the few likely occurrences of these conditions along with the particular circumstances that can cause ice throw.

19.4 It is recognised that the proposal to include battery storage onsite does present a potential risk from fire. However, this is considered a Health and Safety risk (due to the risk of fire being included in the Renewable UK Onshore Wind Health and Safety Guidelines (2015)), opposed to environmental, and as such can be appropriately mitigated through consultation with both the fire brigade and Health and Safety Executive (HSE) outwith of the EIA process.

19.5 Therefore, it is considered unlikely that significant effects will arise as a result of the Proposed Development, and this topic can be scoped out of the further assessment.

[10] https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/index

20. Summary and Conclusions

20.1 This Scoping Report represents notification that the Applicant will undertake an EIA in respect of the Proposed Development and produce an EIA Report to report the findings of the EIA process.

20.2 It also represents a formal application to ECU for a 'Scoping Opinion' as to the information to be provided within the EIA Report that will form part of the S36 application. This report has identified the environmental effects that are considered to have the potential to be significant and proposes the approach to be used in assessments that will be undertaken for the EIA to characterise and understand the significance of these effects. The prescribed consultees are invited to consider the contents of this report and comment accordingly within the statutory period.

RWE

Clachaig Glen Wind Farm

Environmental Impact Assessment Report

Volume 3

Technical Appendices

Appendices

5.2 and 5.3

RWE

Clachaig Glen Wind Farm

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Appendix 5.2: EIA Scoping Opinion

Scottish Government

Energy Consents Unit

Scoping opinion of behalf of Scottish Ministers under Part 4 of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017

Issued to:

RWE Renewables UK Developments UK Ltd in respect of the Clachaig Glen Wind Farm proposal

16 October 2020

CONTENTS

1. Introduction

1.1 This scoping opinion is issued by the Scottish Government Energy Consents Unit ("the ECU") on behalf of the Scottish Ministers to RWE Renewables UK Developments Ltd (the 'Applicant') a company incorporated under the Companies Acts with company number 03758407 and having its registered office at Greenwood House, Westwood Way, Westwood Business Park, Coventry CV4 8PB. This is in response to a request for a scoping opinion made in a scoping report relating to the Clachaig Glen Wind Farm ("the proposed Development") prepared by AECOM Infrastructure & Environment UK Limited on behalf of the Applicant and submitted to the ECU on 07 July 2020.

1.2 Regulation 12 of the Electricity Works (Environmental Impact Assessment)(Scotland) Regulations 2017 is applicable to this scoping opinion.

2. Background

2.1 In December 2019, consent under Town and Country Planning (Scotland) Act 1997 was granted to E.ON Climate & Renewables UK Developments Ltd for the construction and operation of a wind farm at Clachaig Glen, located approximately 1.8 kilometres north east of the hamlet of Muasdale and approximately 20 kilometres north of Campbeltown on the west coast of the Kintyre Peninsula in Argyll and Bute ("the 2019 Development"). The generating capacity of the 2019 Development is 47.6 megawatts and it comprises of:

- 13 turbines with a blade tip height of up to 126.5 metres and hub height of up to 80 metres;
- 1 turbine with a blade tip height of up to 115.5 metres and hub height of up to 69 metres.

2.2 The 2019 Development is solely within the planning authority of Argyll & Bute Council.

2.3 E.ON Climate & Renewables UK Developments Ltd is now RWE Renewables UK Developments Ltd and they are proposing to submit an application for consent under section 36 of the Electricity Act 1989 to construct and operate a wind farm ("the proposed Development") with a generating capacity in excess of 50 megawatts on the existing site of the 2019 Development. It will comprise of the following:

- up to 12 turbines with a blade tip height of up to 180 metres;
- turbine foundations;
- potential battery storage within proposed substation or construction compound areas;
- access tracks connecting infrastructure elements;
- Permanent access: Upgrading of existing 6 km access track (in places) from A83 to the Site)**;**
- hard standing areas e.g. crane pads;
- temporary working areas e.g. construction compound;

- control building and substation and electrical cabling between this and the turbines;
- 1 permanent anemometer mast;
- watercourse and culvert crossings
- potential aviation lighting on-top of nacelle;
- passing places;
- borrow pits;
- forestry; and
- cable trenches.

2.4 Whereas the 2019 Development has consent for 25 years, the proposed Development is seeking consent for an operational period of 35 years. Following this, provided there has been no approval to extend the life, it is expected that the wind farm would then be decommissioned.

2.5 The proposed Development is solely within the planning authority of Argyll & Bute Council.

2.6 Full details of the proposed Development and the rationale for it is laid out in chapter 3 (Project Description) of the Scoping Report prepared and submitted to the ECU by AECOM Infrastructure & Environment UK Limited on behalf of the Applicant 07 July 2020.

3. Consultation

3.1 Following a request for a scoping opinion, the Scottish Ministers are required to carry out a consultation, the purpose of which is to obtain scoping advice on environmental matters within their remit from a range of consultees including internal Scottish Government advisors, Scottish Forestry and Transport Scotland.

3.2 A list of those to be consulted in relation to the proposed Development was agreed between AECOM Infrastructure & Environment UK Limited and the ECU. The list of those consisted is set out in Annex A to this scoping opinion.

3.3 A consultation on the scoping report was initiated on 21 July 2020, the deadline for which, after agreement to extension requests, was 30 September 2020.

3.4 Extensions to the consultation deadline were granted to:

- Argyll & Bute Council;
- Crown Estate Scotland;
- NatureScot; (formally known as Scottish Natural Heritage)
- RSPB Scotland;
- Scottish Forestry;
- Scottish Rights of Way and Access Society (ScotWays);and
- South Knapdale Community Council.

3.5 A total of 18 responses to the scoping consultation were received, all of which are in Annex B (Consultation responses) to this scoping opinion.

3.6 The following consultees did not submit a response:

- Argyll District Salmon Fishery Board;
- British Horse Society;
- Civil Aviation Authority - Airspace;
- Crown Estate Scotland;
- Fisheries Management Scotland;
- John Muir Trust;
- Joint Radio Company;
- Mountaineering Scotland;
- Visit Scotland;
- West of Scotland Archaeology Service;
- East Kintyre Community Council.
- Gigha Community Council;
- South Knapdale Community Council; and
- Tarbert & Skipness Community Council;

3.7 With regard to those consultees who did not respond, it is assumed that they have no comment to make on the scoping report. However, in the event that an application for section 36 consent is submitted, each will be consulted again.

3.8 In their scoping consultation response Glasgow Airport stated that the proposed Development is "*outwith*" their "*consultation zone*" and "*need not be consulted further*".

3.9.8 The Scottish Ministers are satisfied that the requirements for consultation set out in Regulation 12(4) of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 have been met.

3. The Scoping Opinion

3.1 This scoping opinion had been adopted following consultation with Argyll & Bute Council, within whose area the proposed Development will be situated. Historic Environment Scotland ("HES"), NatureScot (formerly Scottish Natural Heritage) and Scottish Environment Protection Agency ("SEPA") were also consulted as statutory consultation bodies, as were other bodies, which the Scottish Ministers considered likely to have an interest in the proposed Development by reason of their specific environmental responsibilities or local and regional competencies.

3.2 The Scottish Ministers adopt this scoping opinion having taken into account the information provided by the Applicant in the scoping report submitted to the ECU on 07 July 2020 and in the responses received to the consultation subsequently undertaken. In providing this scoping opinion, the Scottish Ministers have had regard to current knowledge and methods of assessment, have taken into account the specific characteristics of the proposed Development, the specific characteristics of that type of Development and the environmental features likely to be affected.

3.3 A copy of this scoping opinion has been sent to Argyll & Bute Council for publication on their website. It has also been published on the ECU website at **www.energyconsents.scot**.

3.4 The Scottish Ministers expect the Environmental Impact Assessment report ("the EIA report") which will accompany the application for section 36 consent for the proposed Development to consider any advice given and comply with all particular information requirements set out within the consultation responses in Annex B to this scoping opinion.

3.5 The Scottish Ministers are satisfied with the scope of the environmental impact assessment set out in the scoping report submitted to the ECU by AECOM Infrastructure & Environment UK Limited on behalf of the Applicant 07 July 2020.

3.6 In addition to the advice and guidance provided in the consultation responses, the Scottish Ministers wish to provide the following comments with regards to the scope of the EIA report. The Applicant should note and address each matter:

Aviation – Instrument Flight Procedures for Campbeltown Airport

It is recommended by the Scottish Minsters that the Applicant has discussions with Highlands and Islands Airports Limited with regards to identifying whether or not the proposed Development will impact Instrument Flight Procedures for Campbeltown Airport. If negative impacts are identified, appropriate mitigation to overcome those impacts will have to be identified and agreed. Discussions at the earliest stage will assist in early resolution being negotiated.

Aviation – Lighting

It is recommended by the Scottish Ministers that with regards to impacts of night time aviation lighting the Applicant should discuss and agree with Argyll & Bute Council and NatureScot the range (in kilometres from the proposed Development) for night time assessments of the impacts of night-time aviation lighting and receptors therein to be assessed. As well as the scope, methodology, findings and recommendations of such assessments, full details of all mitigation of aviation lighting impacts subsequently identified should be provided in the EIA Report.

It is also recommended by the Scottish Ministers that the Impacts of nigh time aviation lighting on the Kintyre Dark Discovery Site and the Merrick Wild Land Area be fully assessed and the outcome and findings of which, along with appropriate visualisations, be presented in the EIA report. The Applicant should discuss and agree the finalised content and style of the visualisations with NatureScot.

Battery Storage

In the event that battery storage is to be included in the proposed Development, full details of what it will entail (scale, dimensions etc), its location in the site, minimum and maximum export capacity of megawatts and

megawatt hours of electricity as well as a full suite of appropriate assessments of its impacts and effects and all proposed mitigation should be included in the environmental impact assessment and subsequent EIA report.

Ornithological matters

It is recommended by the Scottish Ministers that the Applicant discuss with RSPB Scotland and NatureScot the need for targeted assessment and mitigation in relation to species of birds of conservation concern which the proposed Development has the potential to impact.

Borrow Pits

The Scottish Ministers recommend that the Applicant take cognisance of the advice and guidance in respect of borrow pits stated in the responses to the scoping consultation from RSPB Scotland, SEPA and Argyll & Bute Council.

Heritage

It is recommended by the Scottish Ministers that the Applicant that the final list of heritage assets and their settings to be made subject to assessment should be discussed and agreed with Historic Environment Scotland.

North Arran Wild Land Area

It is recommended by the Scottish Ministers that the Applicant undertakes a wild land assessment of the North Arran Wild Land Area, the scope and methodology of which should be decided following discussion and agreement between the Applicant and NatureScot.

Viewpoints & Scope of Landscape and Visual Assessment

It is recommended by the Scottish Ministers that the final list of viewpoints and the scope of Landscape and Visual Assessments should be agreed following discussion between the Applicant, Argyll & Bute Council, HES, and NatureScot,

Receptors – noise assessment

It is recommended by the Scottish Ministers that the final list of receptors in respect of noise assessment should be agreed following discussion between the Applicant and Argyll & Bute Council

Cumulative assessment – other Developments

It is recommended by the Scottish Ministers that the assessment range (in kilometres) and other Developments to be included in cumulative assessments should be discussed and agreed with Argyll & Bute Council.

Peat landslide hazard and risk assessment

The Scottish Ministers consider that where there is a demonstrable requirement for peat landslide hazard and risk assessment, the assessment should be undertaken as part of the environmental impact assessment process to provide the Scottish Ministers with a clear understanding of whether the risks are acceptable and capable of being controlled by mitigation measures.

The Peat Landslide Hazard and Risk Assessments: *Best Practice Guide for Proposed Electricity Generation Developments (Second Edition),* published at http://www.gov.scot/Publications/2017/04/8868 should be followed in the preparation of the EIA report, which should contain such an assessment and details of mitigation measures.

It should be noted by the Applicant that the Scottish Ministers engage the services of appropriate specialists to assess Peat Landslide Hazard and Risk Assessments submitted with an EIA report.

Peat Management Plan

The Peat Management Plan to be included in the Construction Environmental Management Plan ("CEMP") should be formulated and finalised following discussions between the Applicant and SEPA.

Private Water Supplies

The Scottish Ministers advise that the Applicant should investigate the presence of any private water supplies which may be impacted by the proposed Development. The EIA report should include details of any supplies identified by this investigation, and if any supplies are identified, the Applicant should provide an assessment of the potential impacts, risks, and any mitigation which would be provided.

Socio-Economic, Recreation and Tourism

The Scottish Ministers recommend that there should be a stand-alone chapter in the EIA report specifically dealing with Socio Economics and that it should include Recreation and Tourism.

Matters to be scoped Out

With regards to matters to be scoped out of the EIA report, the Scottish Ministers advise the Applicant to take cognisance of statements made in the consultation responses from Argyll & Bute Council and NatureScot.

3.7 Marine Scotland, an internal Scottish Government advisor, provide generic scoping guidelines for both onshore wind farm and overhead line development) which outline how fish populations can be impacted during the construction, operation and decommissioning of a wind farm development and informs developers as to what should be considered, in relation to freshwater and diadromous fish and fisheries, during the environmental impact assessment process. That scoping guidance can be viewed at:

www2.gov.scot/Topics/marine/Salmon-Trout-Coarse/Freshwater/Research/onshoreren

3.8 Marine Scotland also provide standing advice for onshore wind farms (which has been appended at Annex A) which outlines what information, relating to freshwater and diadromous fish and fisheries, is expected in the EIA report. Use of the checklist, provided in Annex 1 of the standing advice, should ensure that the EIA report contains the required information; the absence of such information may necessitate requesting additional information which may delay the process.

3.9 The Scottish Ministers are aware that further engagement is required between parties regarding the refinement of the design of the proposed Development especially, but not limited to, surveys, management plans, peat, finalisation of viewpoints, transport routes, cultural heritage, designated sites and cumulative assessments and they request that they are kept informed of relevant discussions.

4. Mitigation Measures

The Scottish Ministers are required to make a reasoned conclusion on the significant effects of the proposed Development on the environment as identified in the environmental impact assessment. The mitigation measures suggested for any significant environmental impacts identified should be presented as a conclusion to each chapter. Applicants are also asked to provide a consolidated schedule, in tabular form, of all mitigation measures proposed in the environmental assessment, where that mitigation is relied upon in relation to reported conclusions of likelihood or significant of impacts.

5. Conclusion

5.1 This scoping opinion is based on information contained in the Applicant's scoping report and advice and guidance subsequently received from consultees in response to the consultation undertaken by the Scottish Ministers. The adoption of this scoping opinion by the Scottish Ministers does not preclude the Scottish Ministers from requiring of the Applicant information in connection with an EIA report submitted in connection with any other application for section 36 consent for the proposed Development.

5.2 This scoping opinion will not prevent the Scottish Ministers from seeking additional information at application stage, for example, to include cumulative impacts of additional developments which enter the planning process after the date of this opinion.

5.3 Without prejudice to that generality, it is recommended that advice regarding the requirement for an additional scoping opinion be sought from the Scottish Ministers in the event that no application has been submitted within 12 months of the date of this scoping opinion.

5.4 It is acknowledged that the environmental impact assessment process is iterative and should inform the final layout and design of proposed developments. The Scottish Ministers note further engagement between relevant parties in relation to the refinement of the design of the proposed Development will be required and would request that they are kept informed of on-going discussions in relation to this.

5.5 Applicants considering submitting applications for section 36 consent are encouraged to engage with officials at the ECU at the pre-application stage and before proposals reach the design freeze.

5.6 Applicants considering submitting applications for section 36 consent are reminded that there will be limited opportunity to materially vary the form and consent of the proposed Development once an application is submitted.

5.7 When finalising the EIA report, Applicants are asked to provide a summary in tabular form of where within the EIA report each of the specific matters raised in this scoping opinion has been addressed.

5.8 It should be noted that to facilitate uploading to the ECU portal, the EIA report and its associated documentation should be divided into appropriately named separate files of size no more than 10 megabytes (MB). In addition, a separate disc containing the EIA report and its associated documentation in electronic format will be required. This should be discussed fully with the ECU at an appropriate stage in the process.

Stephen McFadden
Energy Consents Unit
16 October 2020

ANNEX A LIST OF CONSULTEES

Statutory Consultees

Argyll & Bute Council;
Historic Environment Scotland;
NatureScot (formerly Scottish Natural Heritage – SNH);
Scottish Environment Protection Agency.

Scottish Government Advisors

Marine Scotland;
Scottish Forestry;
Transport Scotland.

Non-statutory consultees

Argyll District Salmon Fishery Board;
British Horse Society;
BT;
Campbeltown Community Council;
Civil Aviation Authority – Airspace;
Crown Estate Scotland;
Dee District Salmon Fisheries Board;
Defence Infrastructure Organisation;
East Kintyre Community Council;
Fisheries Management Scotland;
Giga Community Council;
Glasgow Airport;
Glasgow Prestwick Airport;
Highlands and Islands Airport;
John Muir Trust;
Joint Radio Company;
Mountaineering Scotland;
NATS Safeguarding;
RSPB Scotland;
Scottish Rights of Way and Access Society (ScotWays);
Scottish Water;
South Knapdale Community Council;
Tarbert & Skipness Community Council;
West Kintyre Community Council;
West of Scotland Archaeology Service.

ANNEX B CONSULTATION RESPONSES

Argyll and Bute Council
Comhairle Earra Gháidheal agus Bhóid

Development and Infrastructure Services
Director: Pippa Milne

Council Offices 1A Manse Brae, Lochgilphead, Argyll, PA31 8RD Tel: 01546 604847

Carolanne Brown
Energy Consents Unit
The Scottish Government
4th Floor
5 Atlantic Quay
150 Broomielaw
Glasgow
G2 8LU

1st September 2020

Dear Ms Brown

THE ELECTRICITY WORKS (ENVIRONMENTAL IMPACT ASSESSMENT) (SCOTLAND) REGULATIONS 2017

SCOPING OPINION CONSULTATION RESPONSE FOR PROPOSED SECTION 36 APPLICATION – FOR ERECTION OF 12 TURBINES EACH UP TO A MAXIMUM OF 180 METRES IN HEIGHT TO BLADE TIP, CLACHAIG GLEN WIND FARM, LAND NORTH EAST OF MUSDALE, LOCATED IN THE LOCAL AUTHORITY AREA OF ARGYLL AND BUTE COUNCIL (TO BE SUBJECT OF S36 APPLICATION)

LPA REFERENCE: 20/01325/S36

ECU REFERENCE: ECU00002103

I write in reference to your consultation regarding the above and would thank you for agreeing to extend the response period. Please note that, at time of writing the consultee response remains outstanding from: Argyll & Bute Council's Access Manager. Please find the Council's consultation response to the scoping request enclosed.

I should point out that the issuing of this scoping consultation advice should not be taken to indicate support for the proposal on the part of Argyll & Bute Council. The Council's conclusions on any future application would rely upon the consideration of the content of any accompanying environmental information, the responses of consultees, the views of third parties and any other material planning considerations.

Please note that in terms of the Council's *'Argyll and Bute Local Development Plan'* (adopted 2015) the Council will support renewable energy developments where these are consistent with the principles of sustainable development and it can be adequately demonstrated that there would be no unacceptable significant adverse effects, whether individual or cumulative, including on local communities, natural and historic environments, landscape character and visual amenity, and that the proposals would be compatible with adjacent land uses. Proposed developments will be assessed against the following criteria:

- Net economic impact, including local and community socio-economic benefits such as employment, associated business and supply chain opportunities.
- The scale of contribution to renewable energy generation targets.
- Effect on greenhouse gas emissions.
- Cumulative impacts arising from all of the considerations below.
- Impacts on communities and individual dwellings, including visual impact, residential amenity, noise and shadow flicker.
- Landscape and visual impacts, including effects on wild land.
- Effects on the natural heritage, including birds.
- Impacts on carbon rich soils, using the carbon calculator.
- Public access, including impact on long distance walking and cycling routes and those scenic routes identified in the NPF.
- Impacts on the historic environment, including scheduled monuments, listed buildings and their settings.
- Impacts on tourism and recreation.
- Impacts on aviation and defence interests and seismological recording.
- Impacts on telecommunications and broadcasting installations, particularly ensuring that transmission links are not compromised.
- Impacts on road traffic.
- Impacts on adjacent trunk roads.
- Effects on hydrology, the water environment and flood risk.
- The need for conditions relating to the decommissioning of developments, including ancillary infrastructure, and site restoration.
- Opportunities for energy storage.
- The need for a robust planning obligation to ensure that operators achieve site restoration.

The *'Argyll & Bute Landscape Wind Energy Capacity Study'* (2017) is also a material consideration in the Council's consideration of wind farm applications.

Should you require anything further please do not hesitate to contact me.

Yours sincerely

REDACTED

Arlene Knox
Senior Planning Officer
Major Applications Team
Development & Infrastructure

ELECTRICITY WORKS (ENVIRONMENTAL IMPACT ASSESSMENT) (SCOTLAND) REGULATIONS 2017, REGULATION 12

SCOPING CONSULTATION RESPONSE ON BEHALF OF ARGYLL & BUTE COUNCIL

PROPOSAL: ERECTION OF 12 TURBINES EACH UP TO A MAXIMUM OF 180 METRES IN HEIGHT TO BLADE TIP, CLACHAIG GLEN WIND FARM, LAND NORTH EAST OF MUSDALE, LOCATED IN THE LOCAL AUTHORITY AREA OF ARGYLL AND BUTE COUNCIL (TO BE SUBJECT OF S36 APPLICATION)

THE SITE & PROPOSAL

In December 2019, E.ON Climate & Renewables UK Developments Ltd gained approval under section 47 of the Town and Country Planning (Scotland) Act 1997 and deemed planning permission from Scottish Ministers for a 47.6 MW wind farm at Clachaig Glen. The Consented Development comprises 14 wind turbines (13 with a blade tip height of up to 126.5m and one with a blade tip height of up to 115.5m) and associated infrastructure.

RWE Renewables UK Developments Ltd is proposing to submit a new application under section 36 of the Electricity Act (1989) (as amended) to construct and operate a wind farm with a generating capacity in excess of 50MW on the existing site of the Consented Development. The site boundary and turbine locations of the Consented Development and the 'Proposed Development' are largely identical. The Proposed Development comprises a reduction in turbines onsite with 12 now proposed (down from 14 under the Consented Development) and seeks an increased operational period of 35 years (the operational period is 25 years in the Consented Development). The Proposed Development proposes to increase the blade tip height of the turbines to a maximum 180m, up from the 126.5m maximum tip height in the Consented Development. The Proposed Development maximum rotor diameter is 140m, an increase from the Consented Development which looked to use rotors with a diameter of approximately 101m. The proposed increase in rotor diameters and blade tip height would increase potential renewable energy generation within the site with only minimal changes proposed to the onsite infrastructure approved under the Consented Development.

The Scoping Report recognises Regulation 5(4) under The Electricity Works (Environmental Impact Assessment) (Scotland) Amendment Regulations December 2017, which states: *'With a view to avoiding duplication of assessments, account is to be taken of the available results of other relevant assessments in preparing the EIA report.'* Full details of the previous assessments undertaken for the Consented Development can be found in the *Clachaig Glen Environmental Statement Volume 2a: Main Text* and the associated figures in *Volume 2b* and in *Appendices 9.1 – 9.6* in *Volume 3* (2016 EIA). In order to prevent duplication, reference is given to the 2016 EIA where appropriate in order to highlight where additional assessment should not be required / scope for assessment should be limited in order to prevent duplication.

The site is located on the Kintyre peninsula, approximately 20km north of Campbeltown and 1.8km north east of Muasdale and has an approximate area of 1,360 ha. The A83 between Tarbert and Campbeltown is located approximately 1km to the west of the site. Access to the site can be gained from the A83 turning east onto existing forest roads to the south of Muasdale and at Killean, the latter of which is an existing access track used for the delivery of infrastructure and periodic maintenance access for the Deucheran Hill wind farm and was the approved access outlined in the 2016 EIA.

There are no public roads within the site itself, although there are a number of forest roads. There are a number of properties located within 3km of the site, including several isolated properties located adjacent to the west of the A83 associated with the small settlements of Muasdale, Beacharr and Glenbarr. The closest properties are located at North and South Beachmore, Crubasdale, Low Clachaig, High Clachaig, Aronod and Arnicle. The nearest

residential property to a proposed turbine location is High Clachaig, which is located approximately 1220m from the closest turbine (Turbine 14). It is noted that under the Consented Development High Clachaig is located approximately 850m from Turbine 12 which has now been removed in the Proposed Development, resulting in an increased distance between residential properties and turbine locations.

The majority of the site is dedicated to commercial timber production owned by Forestry & Land Scotland (FLS) with the exception of the summit of Cruach Mhic an t-Saoir (on the eastern boundary of the site) and along the ridge to the south to an unnamed summit at 329m (AOD). The forest is in various stages of growth across the site with operations currently ongoing throughout. The upland areas of the site are dominated by common heather, blaeberry, and grass species with smaller areas of scrub including goat willow and bracken.

The southern part of the site area maintains height from the main eastern ridge at 250m to the south western part. From this ridge the ground falls steeply to 200m in a valley with Clachaig Water before rising to 318m to the north. This main valley, through the centre of which flows Clachaig Water (there are many minor watercourses which converge), falls to 140m at the western boundary of the site, and Clachaig Water continues west where it eventually meets the sea. The site contains a small loch in the crags on the eastern ridge part of the site. Loch na Naich is located outside of the site area but lies immediately adjacent between the land available for associated infrastructure and the existing forest roads. The Kintyre Way Long Distance Route passes the land available for associated infrastructure boundary approximately 200m to the north at the closest point.

The higher areas of the site offer views to the west, across to the Isle of Jura, which extend to the National Scenic Area to the north of the Island.

The Proposed Development would comprise the construction and operation of up to 12 wind turbines, in the same locations as for the Consented Development. The majority of infrastructure elements will largely remain in the same location / at the same scale as that in the 2016 Consented Development. Where changes in proposed site infrastructure may occur, annotation is provided in the project description:

- Up to 12 wind turbines with the maximum rotor diameter being 140m and blade tip heights up to a maximum of 180m **(increase in tip height and rotor diameter);**
- Turbine foundations **(increase in size to accommodate larger turbines);**
- Potential battery storage within proposed substation or construction compound areas **(newly proposed);**
- Access tracks connecting infrastructure elements **(potential for widening and slight realignment within the approved micro-siting to accommodate increased turbine size);**
- Permanent Access: Upgrading of existing 6 km access track (in places) from A83 to the Site **(potential for widening to accommodate increased turbine size);**
- Hard standing areas e.g. crane pads;
- Temporary working areas e.g. construction compound;
- Control building and substation and electrical cabling between this and the turbines;
- Permanent Anemometer Mast (1 no.) located in original 2016 EIA position;
- Watercourse and Culvert Crossings;
- Potential aviation lighting on-top of nacelle **(newly proposed);**
- Passing Places;
- Small Temporary Quarries (borrow pits);
- Forestry; and
- Cable Trenches.

The Proposed Development is also considering the inclusion of battery storage onsite to hold surplus electricity until periods of lower production, resulting in a more even diurnal production profile. If included, battery storage would occur within the proposed substation or construction compound areas. Furthermore, if approval is obtained for the Proposed Development the development of an associated green hydrogen production facility in response to demand from local heat and transport users would be considered and approval would be sought under a separate planning application.

All other infrastructure elements will largely remain in the same location / at the same scale as that in the 2016 Consented Development. In order to accommodate larger turbines some elements will need to be modified e.g. turbine foundations increased and some access roads widened. Furthermore, due to the increased size in turbine tip height there is the potential requirement for aviation lighting on turbine nacelles.

The Proposed Development would be designed with an operational life of 35 years. Following this, provided there has been no approval to extend the life, it is expected that the wind farm would then be decommissioned.

The Council considers that the content of the 'Scoping Report' dated 8th July 2020 is broadly acceptable, and it is considered that the proposed scope of the environmental assessments detailed therein will form a generally appropriate structure for EIA Report (EIAR) preparation. In accordance with the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, Argyll and Bute Council would comment as follows on the information to be provided in the EIAR.

CONSIDERATION OF ALTERNATIVES

The EIA Regulations require that an EIA includes: *'an outline of the main alternatives studied by the applicant or appellant and an indication of the main reasons for the choice made, taking into account the environmental effects.'* It is noted from the Scoping Report that layout options will be considered including candidate wind turbine models, the number and location of turbines, and battery storage design throughout the EIA process. The site infrastructure already approved under the Consented Development will largely stay the same as that in the Consented Development. The scale and layout of the development should be designed so as to minimise the impact of the development upon key environmental features, significant views and sites designated for their ecological/historical or scenic qualities.

BUILT ELEMENTS

The EIAR should identify the location of all built elements, which should be sited to avoid habitats of importance, wetlands, areas of deep peat and blanket bog, watercourses and abstractions, in order that areas of particular vulnerability to damage from development, or which have higher pollution sensitivity, may be protected from unnecessary impacts associated with the development. The assessment should address the construction, operational and decommissioning phases of the development.

EIA SCOPING

The scope is cognisant of The Electricity Works (Environmental Impact Assessment) (Scotland) Amendment Regulations December 2017 which make it clear that where appropriate reference should be given to previous assessments in order to highlight where additional assessment should not be required / scope for assessment should be limited in order to prevent duplication. As the Proposed Development primarily relates to an increase in rotor diameter and maximum blade tip height of turbines, with all other infrastructure,

construction programme, decommissioning proposals etc. all largely remaining unchanged, the upcoming EIA will primarily focus on impacts likely to arise from the increased turbine size with the 2016 EIA referenced where possible to prevent assessment duplication. However, where deemed necessary updated baselines and impact assessments will be provided in individual chapters. The Council is satisfied with this approach.

PLANNING POLICY CONTEXT

The scope of the Planning Policy Context detailed in the Scoping Report is acknowledged. It identifies the relevant national and local planning policies that are likely to be relevant when determining the application for consent, as well as the national renewable energy and climate change policy context; legislation and guidance and other material considerations. It is noted that the changes to NPF and SPP have been acknowledged as well as that Argyll and Bute Council are currently in the process of preparing a new Local Development Plan (LDP2). The Council is satisfied with this approach.

RENEWABLE ENERGY & CLIMATE CHANGE POLICY FRAMEWORK

The scope of the Renewable Energy & Climate Change Policy Framework consideration in the Scoping Report is acknowledged. It is noted that the EIA will be progressed taking account of applicable legislation, policy and guidance in relation to renewable energy. This section of the EIA Report will set out the policy and energy target context for renewable energy projects from a European, UK and Scottish perspective as well as providing the carbon balance assessment. The Council is satisfied with this approach.

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

It is noted from the Scoping Report that this chapter will set out the proposed scope of the revised Landscape and Visual Impact Assessment (LVIA) which will assess the likely significant effects, including cumulative effect of the proposal on landscape and visual amenity receptors. Furthermore that related technical assessment would include a Night-time Lighting Assessment. It is noted that the LVIA will be carried out in accordance with current guidance and best practice documents including the Guidelines for Landscape and Visual Impact Assessment4 (GLVIA) and other relevant guidance issued by NatureScot, Argyll and Bute Council and the Scottish Government.

The Council is not aware of any additional wind farms relevant to the cumulative assessment in addition to those presented in Table 7.2 at this time. It is noted that the viewpoints have been selected from those agreed with statutory consultees for the 2016 EIA and represent a refined list of locations to allow a more focused assessment of likely significant effects. Table 7.1 Viewpoint Locations – the Council recommends that additional viewpoints are provided from Dun Skeig, Scheduled Monument; and A'Cleit, Category A listed building, as the ZTV suggests that there will be some visibility from these important historical sites. The Council also recommends that consideration is given to the production of some comparative wirelines and photomontages which display the difference between the Consented Development and the Proposed Development to assist in the understanding of the difference between the 2 schemes in terms of Landscape and Visual Impact (a similar approach was adopted for Tangy 4 - ECU00000673) The Council understands that the advice of: NatureScot, and Historic Environment Scotland, will also be sought in regard to this chapter of the EIAR where relevant.

NOISE, VIBRATION, AIR QUALITY, AND LIGHTING

It is noted from this section of the Scoping Report that the noise impact assessment will identify and assess potential noise effects of the proposal on Noise Sensitive Receptors (NSRs). The assessment will be undertaken in accordance with ETSU-R-97 – 'The Assessment and Rating

of Noise from Wind Farms' and the Good Practice Guide published by the Institute of Acoustics in 2013 (IOA GPG). Noise impacts could arise from three distinct areas of a wind farm development: Construction and decommissioning of the wind farm; Operation of the wind farm; and Increased traffic flow during the construction, operational and decommissioning phases. Furthermore, that this chapter refers to the Noise chapter of the EIA which accompanied the planning application for the consented Clachaig Glen 2016 wind farm (2016 EIA).

The Council's Environmental Protection Officer notes that the proposed development is for a new wind farm and associated infrastructure on land approximately 5km northeast of Muasdale. The site currently holds planning consent for a similar development of 14 turbines following an earlier application and public inquiry. The majority of infrastructure is of a similar nature to the consented development but with 2 fewer turbines. The 12 turbines are proposed to be a maximum 180m to blade tip and the development will include the provision for battery storage on site.

The wind farm is planned for a rural afforested area located to the east of the A83. The nearest occupied residential properties are sited at the points listed in the table below:

	Turbine	Distance
High Crubasdale	T10	2121m
North Crubasdale	T10	2230m
South Beachmore	T10	2324m
North Beachmore	T10	2025m
Beachmenach	T10	2283m
Beacharr	T4	2120m
Various properties, Arnicle	T14	3010m

There are also nearby properties that are not currently occupied and a plot that holds planning consent for residential property listed in the following table:

	Turbine	Distance
High Clachaig	T10	1251m
Low Clachaig	T10	1941m
Garvalt Building Plot	T14	2337m

The main issues of concern to Regulatory Services would be: operational noise; construction noise and vibration; air pollution, such as dust during construction phase; lighting during construction phase; and private water supplies (see comments in hydrology section).

Operational Noise - It is proposed that the noise impact assessment (NIA) will rely on the baseline data collected to support application 16/01313/PP and it is accepted that this is an appropriate and conservative approach. On the turbine layout included in the Scoping Report (SR) there are no occupied residential properties within 2km of any turbine. Since the compilation of the previous NIA, a site at Garvalt (E172004, N638949) has been granted

planning consent for a dwelling. However, it is recognised that this property, if constructed, would sit well outside the 35dB noise contour.

The SR has identified operational noise as an impact to be considered by any environmental impact assessment and has included preliminary calculations which demonstrate compliance with limits in the consent 16/01313/PP. The SR states that noise will be assessed in accordance with the methodology set out in ETSU-R-97 and the IoA Good Practice Guide. It is expected that the noise impact assessment (NIA) containing sufficient detail and calculations would be provided with the application. In addition:

- Any NIA should consider the potential impact at any dwelling which is lawfully existing or a site which has planning permission for use as a dwelling.

- If it is anticipated that mitigation measures (e.g. operation of turbines in noise reduced mode) may be required to achieve prospective noise limits then details should be included in the NIA.

- It is acceptable for turbine noise predictions to be undertaken using the characteristics of an appropriate candidate turbine. It should be expected that any planning approval will include a condition which requires the demonstration of compliance of the turbines to be installed with any noise limits included in the consent.

- Where the occupiers of any properties are considered to have a financial interest in the development and a higher noise limit of 45dB $LA_{90,\ 10\ mins}$ is proposed, details of the properties concerned and factors supporting the financial interest shall be provided to the Planning Authority.

- The NIA should also consider any potential impact of fixed (non-turbine) noise-generating equipment on the nearest noise-sensitive properties. The NIA should outline any proposed mitigation measures.

- The report identifies the potential for the cumulative noise impact with other similar developments and the SR identifies relevant sites which are both operational and currently within the planning system at the application or appeal stage and should be included in the NIA.

- Where calculations have been undertaken and corrections have been made in accordance with IoA Good Practice Guide recommendations (e.g. across a valley or topographical screening) the NIA should include a table providing full details.

Construction Noise and Vibration – The scoping report indicates that due to distance it is unlikely that construction noise will not result in significant adverse impact. It would be expected that details of operations and mitigation measures will be in accordance with good practice recommended by BS 5228-1:2009 + A1:2014 and included in a construction environmental management plan.

Air Quality - The applicants should consider the potential for dust emissions from the site and access roads/tracks during the construction phase on any nearby sensitive properties and provide details of any proposed mitigation measures within a construction environmental management plan.

Lighting - The applicant should consider the potential for light pollution during the construction phase on any nearby sensitive properties.

ECOLOGY

It is noted from the Scoping Report that this chapter will address terrestrial and freshwater ecology and that ornithology will be considered under a separate chapter. Furthermore that the approach to Scoping for ecology accords with the *Guidelines for Ecological Impact Assessment in the UK and Ireland*, published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018) and that the scope of survey and assessment proposed has been informed by the results of detailed study completed for the 2016 EIA, carried out between 2014 – 2016. In addition, a desk study has been carried out in 2020 to review the results of ecology study completed to date and to update that information where relevant.

The Council's Local Biodiversity Officer (LBO) has provided the following advice in relation to biodiversity interest, surveys, mitigation and construction environment management, habitat management and Restoration protocols:

Water Courses – notes a number of water courses will need to be culverted to allow access throughout the site- provision for silt catchment needs to be included, along with regular checks to maintain clear culverts.

Designations – notes that there are no Natural Heritage Designation within the site however, native woodland was identified to the south west of the site.

Ecological Studies: Summary – notes field surveys were completed in 2013 and 2015/16 for habitats, vegetation and species: Otter *Lutra lutra* (EPS), Water vole *Arvicola amphibious,* Badger *Meles meles;* Pine marten *Martes martes;* Red squirrel *Sciurus vulgaris*; Wildcat *Felis sylvestris*; Reptiles, amphibians and arthropods; Fish species; Freshwater pearl mussel *Margaritifera margaritifera* and Bats (EPS). Notes that further survey work is planned for 2020, factoring in Covid 19 lockdown, the LBO expects some updating of previous surveys to be carried over into 2021.

Habitats: note of survey types

1. Phase 1 habitat survey *within 250m of Proposed Development footprint and within 110m of main access track.*

2. National Vegetation Classification (NVC) *within 250m of Proposed Development footprint and within 110m of main access track. Compilation of a comprehensive plant species list.*

Habitat List: Noted: The most extensive habitat is conifer plantation, wet heath, blanket bog and marshy grassland, with smaller areas of other habitats including bracken *Pteridium aquilinum*, acid/neutral flush, improved grassland, neutral grassland and acid grassland, and semi-natural woodland along parts of the lower access track.

The following habitats are listed on the Scottish Biodiversity List (SBL):

- Northern Atlantic wet heaths with Erica tetralix (comprising areas of wet dwarf shrub heath, locally extensive in open upland parts of the Site and along some forestry rides, of NVC community M15);

- European dry heaths (comprising localised smaller areas of dry dwarf shrub heath of NVC communities H10, H12 and, very locally, H21); and,

- Blanket bog (comprising areas of bog, extensive in the open upland parts of the Site, supporting the NVC communities M19, M17 and M18 in decreasing order of abundance).

Proposed site habitats list below:

• Wet woodland;
• Upland heathland;
• Purple moor-grass and rush pasture;
• Upland flushes, fens and swamps;
• Rivers; and,
• Oligotrophic and dystrophic lakes.

Peat and Watercourses

Peat – notes the details of the peat depth survey as in 2.2 map and the EIA details in terms of the Carbon Calculator. The applicant is committed to maintaining the existing hydrological regime, particularly in blanket bog and groundwater dependent terrestrial ecosystems.

Advice – a Peat Management Plan for both the construction and decommissioning phases needs to be included in the proposed Construction Environment Management Plan which is to be overseen by an Ecological Clerk of Works.

Watercourses – notes the details in 2.3 map and that the design of watercourse crossings will be passable to fish, otter and water vole; details must include silt catchment and culvert maintenance, all details to be included in the CEMP.

Species

1. Bats *(European Protected Species- EPS)*[i]

- Pipistrelle species*: no roosts or potential roosts confirmed. Transect surveys – sparsely distributed, low level of activity recorded.*

  Static detector monitoring – low levels of activity and no apparent spatial or temporal pattern.

- Brown long-eared; *Roost suitability assessment – no roosts or potential roosts confirmed. Coniferous woodland offers negligible roosting habitat.*

  Transect surveys – no activity recorded.

  Static detector monitoring - activity recorded at extremely low levels, with a very restricted distribution in the survey area.

- Myotis species; *Roost suitability assessment – no roosts or potential roosts confirmed. Coniferous woodland offers negligible roosting habitat.*

  Transect surveys – no activity recorded.

  Static detector monitoring – low level of activity in the Ecology Survey Area. No apparent spatial or temporal pattern.

- Unidentified or indeterminate bat species; *Roost Assessment: No roosts or potential roosts confirmed. Coniferous woodland offers negligible roosting habitat.*

  Transect Surveys: Sparsely distributed low level of activity recorded.
  Remote monitoring: Low intensity of activity and no apparent spatial or temporal pattern.

2. Otter- EPS- Evidence of otter was recorded along the Killean Burn but no signs within the proposed site.

3. Water Vole *(Protected Species):* Multiple signs including feeding remains, a latrine and potential burrows were recorded along a short stretch of the main course of the Clachaig Water in 2015. Habitat suitability generally unfavourable in other areas. Records were more than 250m from the only upstream watercourse crossing.

4. Badger: no evidence on this site but aware that they may be in the local area.

5. Red Squirrel, No sightings or evidence recorded in 2013 or 2015/16.

6. Wildcat, No sightings or evidence recorded in 2013 or 2015/16.

7. Pine Marten, A single scat recorded in 2013 but no sightings or evidence recorded in 2015.

8. Reptiles, Common lizard *Zootoca vivipara* and adder *Vipera berus* recorded occasionally in 2013 and 2015/16.

9. Amphibians, No observations or evidence recorded in 2013. Common frog *Rana temporaria* and common toad *Bufo bufo* recorded occasionally in 2015/16.

10. Arthropods, Some pockets of habitat of particular value for arthropods identified, but these are all of ecological value in their own right, thus arthropods are likely to be safeguarded indirectly.

11. Fish, Brown trout; land locked and mostly fry and parr, this is typical of such water courses. Other fish species; No other notable fish species as obstacles to migration prevent these migratory fish establishing within the site.

12. Freshwater Pearl Mussel; *none recorded as there are no suitable.*

13. Ornithological *interest details under separate heading*

14. Any Invasive Non-Native Species- none reported.

LBO Comment: the applicant's ecologist have been contracted to carry out follow up surveys in 2020, due to Covid-19 and lockdown, the LBO is content to wait for up to date surveys when they become available.

LBO General Comment: the LBO acknowledges the level of supporting biodiversity information that accompanied this application. This proposal has been subject to a series of ecological, ornithological and hydrological surveys, some of which require updating as they are past the 18 month timescale and due this year 2020, however in view of Convid-19, the LBO is content to wait until they become available in order to provide further comment. The proposed mitigation in the current surveys is in line with accepted practice, this needs to be included in the HMP management plans and form part of the Construction Environmental Management Plan.

There is an outstanding issue relating to the location of the borrow pits and passing places; the LBO requires further information on the final location of the borrow pits and passing places along with details of the treatment and storage of the vegetative cover and soil to be used restoration plan.

The LBO looks forward to being consulted on the updated ecological surveys, the draft Construction Environmental Management Plan and Toolbox talks and to include Habitat Management Plans when they become available. The link to Argyll & Bute Planning Service, A Biodiversity Technical Note for Planners and Developers, February 2017 is provided below.

https://www.argyll-bute.gov.uk/sites/default/files/biodiversity_technical_note_feb_2017_4.pdf

[1] European Protected Species

Offences: In terms of any development of a site, it is illegal to destroy or damage a breeding site or resting place of a European Protected Species. In respect of the strict liability, the animal does not have to be presently using such a breeding site or resting place for an offence to be committed. Being a 'strict liability' or absolute offence this means ignorance and lack of any intention to damage the breeding site/ resting place is no defence in law and will subsequently lead to prosecution. Under this legislation the following are offences if undertaken deliberately or recklessly:

- capture, injure or kill a wild animal which is a European Protected Species (EPS);
- capture or harass a wild animal or group of wild animals of EPS;
- to disturb such an animal while it is occupying a structure or place it uses for shelter or protection;
- to disturb such an animal while it is rearing or otherwise caring for its young;
- obstructing access to a breeding site or resting place, or otherwise denying the animal the use of a breeding site or resting place;
- to disturb such an animal in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species to which it belongs;
- To disturb such an animal in a manner that is, or in circumstances which are, likely to impair its ability to survive, breed or reproduce, or rear or otherwise care for its young;
- to take or destroy the eggs of such an animal;
- deliberately or recklessly disturbing such an animal while it is migrating or hibernating;
- to disturb any dolphin, porpoise or whale (cetacean);
- To pick, collect, cut, uproot or destroy a wild plant of EPS.

The Council understands that consultations will also be undertaken with Forestry and Land Scotland (FLS), and NatureScot regarding the proposed scope of surveys.

ORNITHOLOGY

It is noted from the Scoping Report that the approach to Scoping for ornithology accords with the *Guidelines for Ecological Impact Assessment in the UK and Ireland*, published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018). It is also based on the *recommended bird survey methods to inform impact assessment of onshore wind farms*, published by Scottish Natural Heritage (SNH, 2017). The scope of survey and assessment proposed has been informed by the results of detailed study completed for the 2016 EIA, carried out between 2014 – 2016, and on further ornithology survey carried out for the revised proposal in 2018 and 2019. In addition, a desk study has been carried out in 2020 to review the results of ornithology study completed to date and to update that information where relevant. It is noted that NatureScot has already been consulted in 2020 on the scope of ornithology assessment. AECOM provided an overview of the ornithological field survey completed to date and NatureScot responded, advising that:

- the revised application for the Proposed Development will need to include a full assessment of all key species and include revised collision risk modelling based on the new layout and increased size of turbines;

- one of the main ornithological sensitivities for the site is golden eagle;
- If the planning application for the Proposed Development is not submitted until 2021, NatureScot considers that the 2015 breeding bird data would be too dated. As a result, they would therefore recommend that a further breeding season worth of survey should be carried out in 2020.

The Council's Local Biodiversity Officer (LBO) has responded to biodiversity interest, surveys, mitigation and construction environment management, Habitat Management and Restoration protocols as follows:

The LBO notes that the key species recorded by the Ornithological Survey are: Greenland white-fronted goose *Anser albifrons flavirostris;* Golden eagle; sensitive species. *Aquila chrysaetos*; Hen harrier *Circus cyaneus;* Red-throated diver; *Gavia arctica*; Black grouse; *Tetrao tetrix* and Breeding moorland waders, including golden plover *Pluvialis apricaria* and curlew *Numenius arquata.*

The LBO notes the details of the various surveys (timing and rechecking of data) that have followed accepted protocols, these will help inform an update on the previous collision risk modelling which was carried out on a higher density of turbines. The current application is noted as a reduction in the number of turbines and the larger turbine sizes. The applicant will carry out the revised collision risk modelling by using two different datasets: one which contains the results of vantage point surveys carried out between 2014 – 2016; and one which uses the results of these surveys between 2018 – 2020. This is because different VP locations were used during these periods, and the results are therefore not directly compatible for the purposes of collision risk modelling.

Borrow pits and Passing Places – the LBO requests further information in terms of the location of the borrow pits and passing places and what habitats will be effected by the excavation process. A Borrow Pit and Passing Place Management Plan will need to be drafted with a focus on the treatment of surface vegetation (turves) and soil; a restoration plan will need to be included for the borrow pits and appropriate passing places where applicable.

Proposed Mitigation – the LBO notes that the applicant proposed the following suite of action in order to reduce the impact of the construction albeit that planning permission is granted:

- *removal of habitat which may be suitable for nesting birds outside of the breeding season (taken to be March to August, inclusive);*
- *pre-construction and pre-felling checks for nesting birds;*
- *implementing works exclusion zones around specially protected species to ensure that they are not disturbed or otherwise directly harmed during construction;*
- *Timing of works to avoid sensitive periods of the day (e.g. avoiding the period around dawn when black grouse lekking activity is at a peak).*

In terms of where significant effects cannot be avoided, the applicant wishes to provide proportionate compensatory measures where possible along with ecological enhancement in the Proposed Development.

LBO Comment: The LBO welcomes the proposed mitigation and inclusion of compensatory measures and ecological enhancement, and notes that these have to be fully explored and measures designed to restore specific areas within the proposed site; these measures should form part of the Habitat Management Plan (HMP). The LBO would like a copy of same when it becomes available and recommend that these are included in the CEMP along with Toolbox talks, the latter to include a watching brief on protected species.

The Council understand that consultation will be undertaken with NatureScot and the RSPB in order to outline the scope and results of the surveys undertaken to inform the ornithological impact assessment.

GEOLOGY, HYDROLOGY AND HYDROGEOLOGY

It is noted from the Scoping Report that the EIA will consider the potential issues arising from the construction, operation and decommissioning of the Proposed Development in relation to existing and future potential geological, hydrological and hydrogeological conditions.

Private Water Supplies - The Council's Environmental Protection Officer has advised that the proposed development is in an area where residential properties are served by private water supplies which is recognised by the SR. The applicants should identify all properties served by a private water supply, to determine the source of those supplies that may be affected (e.g. surface supply, borehole etc.) and, where appropriate, should outline the proposed measures to avoid causing contamination during the construction and operational phases.

Where a private water supply is to be provided at the construction site or any facilities in use during the operational phase (for drinking water, toilets etc.) details of the source of this supply and any proposed treatment should be outlined (the supply will be required to meet the standard of the Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017).

Furthermore, it is recommended that consultations with SEPA and Argyll & Bute Council are undertaken where necessary.

CULTURAL HERITAGE

It is noted from the Scoping Report that cultural heritage (archaeology, built heritage and historic landscapes) are proposed to be scoped into the EIA due to the potential for the proposed development to affect designated and non-designated heritage assets. Furthermore, that the EIA Cultural Heritage chapter will assess the impacts and effects of the Proposed Development and set out methods to mitigate adverse effects.

The West of Scotland Archaeology Service have advised that without access to their GIS, database and archive systems, they can't check on the details contained in the Scoping Report at this time, however, the topics cited and the proposed actions appear appropriate. WoSAS would by necessity reserve comment on the detailed methodology until they see it and have access to all of their office-based information systems.

WoSAS General Comments - This is a very large area in Argyll where unrecorded sites are common so without some form of on-site survey, WoSAS are not content to agree that the recorded sites represented the full range of material present because currently it would be possible for construction to affect unrecorded elements of the historic environment. WoSAS suggest including pre and/or post-felling walkover survey or a sufficiently detailed LiDAR survey as possible alternatives as to how the applicant might address this aspect.

WOSAS advise the need for further consultation on the final selection of assets for further setting assessment and to this WOSAS would add potentially nationally significant sites (C and V category) from the former Non-Statutory Register (NSR). WOSAS generally advise a 10km extent for setting assessments but given the size of the turbines this may need to be increased, hence the requirement for further consultation when WOSAS have full access to their office based systems to enable detailed assessment to be undertaken.

The Council recommends that additional viewpoints are provided from the Scheduled Monument Dun Skeig and Category A listed A'Cleit Church to enable assessment of the impact of the proposal on these important historical assets. The Council would also ask that

consideration is given in any replanting plan and access/turning area design for provision of appropriate new planting to protect and maintain the setting of the Category A listed 'Dolls houses', which lie adjacent to said access. Furthermore, it is understood that consultation with HES and WoSAS will also be undertaken in regard to this area of the assessment.

SOCIO-ECONOMICS, TOURISM, AND RECREATION

Wind farms have the potential to have both beneficial and negative effects on socio-economics, tourism and recreation. It is noted from the Scoping Report that the 2016 EIA did not identify any significant adverse impacts for socio-economics, tourism and recreation as a result of the Consented Development. Furthermore, that it is not anticipated that the results from the 2016 EIA will change, however, for completeness an EIA chapter with an updated baseline and impact assessment will be provided. Scottish Planning Policy in regard to wind farm development sets out a number of assessment criteria. These include consideration of effects on the local and national economy and tourism and recreation interests, in addition to benefits and disbenefits for communities. Tourism and recreation are important industries for the economy of Argyll and Bute and the local area. The EIA Report should address the consequences of the development for users of the countryside, and tourism and recreation interests, including any deterrent influence the proposal may have, along with any attractive influence the presence of the proposal may generate. The proposal should not result in the unacceptable loss of amenity to individuals who enjoy recreation pursuits on land or water.

TRAFFIC, TRANSPORT AND ACCESS

It is noted from the Scoping Report that this chapter of the EIA will consider the potential for the impacts of the proposed development on traffic and transport. Construction of the proposed development is expected to result in the highest volume of traffic generation therefore it is proposed that operational and decommissioning transport impacts are scoped out of the EIA and that the justification for scoping out these phases would be further detailed within this chapter. The Council's Area Roads Engineer advises that they have no objection to the proposal, furthermore that Transport Scotland should be notified as the site entrance connects directly to the A83 Tarbet – Campbeltown Trunk Road. The Council also understands that the views of Transport Scotland will be taken into account in respect to traffic, transport and access matters.

INFRASTRUCTURE AND TELECOMMUNICATIONS

Wind turbines can affect communication systems that utilise electromagnetic waves as their means of transmission. It is therefore necessary to ensure turbines are separated from telecommunications links by suitable distances to avoid interference. Utilities infrastructure (such as gas pipelines and overhead cables) also needs to be considered to ensure the Proposed Development does not have a significant effect on this infrastructure. It is noted from the Scoping Report that the initial OFCOM consultation identified a number of links that intersect the proposed site or are within the vicinity of the consented development. Furthermore, that further consultation, using the new proposed turbine dimensions and positions, will be undertaken with OFCOM for the newly Proposed Development to identify any changes to the links mentioned above. Service providers will contacted as a result of this consultation. The Council is satisfied with this approach.

AIR SAFEGUARDING

Wind turbines within radar Line of Sight (LoS), and therefore detectable by radar systems, reflect radio waves that can interfere with the system. Turbine induced radar clutter appearing on radar displays can affect the safe provision of Air Traffic Services as it can mask unidentified aircraft from the air traffic controller and/or prevent the accurate continued identification of aircraft under control. In some cases, radar reflections from the turbines can

affect the performance of the radar system itself. Additionally, due to their height, wind turbines could also potentially present a collision risk to low flying aircraft, therefore affecting military low-level training flights. It is noted from the Scoping Report that an assessment of civil and military aviation, defence, will be undertaken and will include consultation with the relevant organisations in regard to any potential effect the proposal will have. The Council is satisfied with this approach.

FORESTRY

The Scoping Report details the way in which potential effects of the proposal on the woodland/forestry areas within the site will be assessed. It is noted that the forestry impact of the proposal will be addressed in the development of a Wind Farm Forest Design Plan (WFFDP). Furthermore, that the proposed WFFDP will take into account the Scottish Government's Control of Woodland Removal Policy, the UK Forest Standard and other relevant regulations and guidelines. The Council is satisfied with this approach, and understands that advice will be sought from NatureScot and Forestry Land Scotland in this regard.

SHADOW FLICKER

It is noted from the Scoping Report that properties are present along the west of the proposed site. Shadow flicker effects have been proven to only occur within ten rotor diameters of a turbine and only properties within 130o either side of north, relative to the turbines can be affected. Furthermore, that the assessment study area was defined as the area over which shadow flicker effects could affect properties (i.e. within 10 rotor diameters of each turbine). Given the parameters of the Proposed Development a buffer radius of 1,450 m was applied to each turbine location to determine the overall study area, (based on a maximum 140m rotor width plus a 50m proposed micro-siting allowance). A single property, known as High Clachaig, is located within the study area, 0.5 km southwest of the proposal and within 1220m of the closest turbine (Turbine 14). A site visit was undertaken on 21 December 2015 to determine the location of windows at the High Clachaig residential property. It was confirmed that none of the windows of this property face the direction of the wind farm, however a shadow flicker assessment will still be undertaken. The proposed turbines are located approximately 1.1 km from the nearest core path/cycle route. As the proposed blade tip height is a maximum of 180 m, the turbines are therefore located well in excess of the 3 times blade tip height (540m) separation distance recommended by the British Horse Society to avoid distress to horses from shadow flicker (BHS, 2014). The effect on pedestrians and horse riders has therefore not been considered further and is expected to be negligible. The Council is satisfied with this approach.

MAJOR ACCIDENTS AND DISASTERS (INCLUDING CLIMATE CHANGE)

It is noted from the Scoping Report that none of the following climate trends identified in UKCP091310 could affect the Proposed Development with the exception of increased windstorms: increased temperature; changes in the frequency, intensity and distribution of rainfall events; increased windstorms; and sea level rise. Braking mechanisms installed on turbines allow them to be operated only under specific wind speeds and should severe windstorms be experienced, then the turbines would be shut down. In addition, given the elevated location of the project area, flooding will not pose a significant risk to the operation of the wind farm nor will the construction of the proposed development contribute to flooding elsewhere. The potential for ice throw to occur after turbine start up following a shut down during conditions suitable for ice formation is high. There are monitoring systems and protocols in place to ensure that turbines that have been stationary during icing conditions are restarted in a controlled manner to ensure public safety. The risk to public safety is considered to be very low due to the few likely occurrences of these conditions along with the particular circumstances that can cause ice throw. It is

recognised that the proposal to include battery storage onsite does present a potential risk from fire. However, this is considered a Health and Safety risk (due to the risk of fire being included in the Renewable UK Onshore Wind Health and Safety Guidelines (2015)), opposed to environmental, and as such can be appropriately mitigated through consultation with both the fire brigade and Health and Safety Executive (HSE) outwith of the EIA process. Consequently, it is noted that it is considered unlikely that significant effects will arise as a result of the proposed development and this topic is proposed to be scoped out of further assessment. The Council is satisfied with this approach.

DECOMMISSIONING

Decommissioning effects are those effects that will occur during the decommissioning and removal of the wind farm infrastructure at the end of its 25-year operational lifetime. It is noted from the Scoping Report that the effects of the Proposed Development will be assessed for the construction, operational and decommissioning phases. The Council is satisfied with this approach.

GRID CONNECTION

There is no reference to the grid connection in the Scoping Report. It is acknowledged that it falls under a separate consenting regime, and will not form part of the assessment, however it is normal for general information on the route of the grid connection to be set out in the EIAR.

REDACTED

Arlene Knox
Senior Planning Officer
Major Applications
1st September 2020

Consultations undertaken

Argyll & Bute Council Local Biodiversity Officer (24th August 2020)
Argyll & Bute Council Environmental Health Officer (26th August 2020)
Argyll & Bute Council Area Roads Engineer (10th August 2020)
Argyll & Bute Council Access Manager – no response at time of writing
Argyll & Bute Council Archaeological Advisors the West of Scotland Archaeology Service – (26th August 2020)

A18

REDACTED

From: lisa.4.smith@bt.com
Sent: 24 July 2020 09:49
To: Econsents Admin
Cc: Brown C (Carolanne); radionetworkprotection@bt.com
Subject: RE: Clachaig Glen Wind Farm proposal - scoping consultation - WID11284

OUR REF: WID11284

Dear Sir/Madam

Thank you for your email dated 21/07/2020.

We have studied this Wind Farm proposal with respect to EMC and related problems to BT point-to-point microwave radio links.

The conclusion is that, the Project indicated should not cause interference to BT's current and presently planned radio network.

Please direct all queries to radionetworkprotection@bt.com

Regards
Lisa Smith
Engineering Services Radio Planning
Tel: REDACTED

A19

From: enquiries@campbeltowncommunitycouncil.uk

To: Carolanne Brown, Energy Consents Unit

Date: 13 August 2020

ECU00002103

Dear Caroline,

I apologise for failing to send the response of Campbeltown Community Council to this Scoping Opinion Request before the deadlline on the 11th August. I have tried to send it this morning to Econsents_Admin@gov.scot, but it comes up, not a valid email address.

Here is our response.

Response to **ECU00002103 SCOPING OPINION REQUEST– CLACHAIG GLEN WIND FARM PROPOSAL, ARGYLL & BUTE** from Campbeltown Community Council

While Campbeltown Community Council has no significant objection to the proposed Windfarm development at Clachaig Glen, there are some issues that require to be safeguarded.

It would appear that the increased height of the turbines in the proposed new development would require nighttime lighting. This would impact on Kintyre's designation as a "Dark Sky Discovery Site" and on potential tourism. Lighting should be kept to a minimum.

There are significant numbers of heritage assets, standing stones with cup and ring markings, Cairns and at least one dun dating back to the 5th Century. These could be damaged during construction and others not known about could be destroyed. Care must be taken to protect these.

One of the relatively few areas of natural broadleaved woodland in Kintyre is in Clachaig Glen. Loss or damage to this area could have considerable impact on wildlife and so again this area requires protection.

By far the greatest problem for the community of Campbeltown would be in the construction phase when locals could be delayed by movement of hazardous loads. Movements at night can cause disruptions due to noise and vibrations. These should be kept to a minimum.

Campbeltown Community Council.

A20

Defence Infrastructure Organisation

Teena Oulaghan
Safeguarding Manager
Ministry of Defence
Safeguarding Department
Kingston Road
Sutton Coldfield
West Midlands B75 7RL
United Kingdom

Telephone [MOD]: REDACTED

E-mail: teena.oulaghan100@mod.gov.uk

Your Reference: ECU00002103

Our Reference: DIO10036239

Carolanne Brown
Energy Consents Unit
Scottish Government,
4th Floor,
5 Atlantic Quay,
150 Broomielaw,
Glasgow,
G2 8LU

29 July 2020

Dear Carolanne,

THE ELECTRICITY ACT 1989 THE ELECTRICITY WORKS (ENVIRONMENTAL IMPACT ASSESSMENT) (SCOTLAND) REGULATIONS 2017. SCOPING OPINION REQUEST– CLACHAIG GLEN WIND FARM PROPOSAL, ARGYLL & BUTE

Thank you for consulting the Ministry of Defence (MOD) on the above scoping opinion request in your communication dated 21 July 2020.

I am writing to tell you that the MOD has no objection to the proposal.

Planning permission was granted for a wind farm at Clachaig Glen following a Public Inquiry in December 2019. The consented development comprises the construction of a wind farm with a generation capacity of 47.6MW, its operation for a period of 25 years and makes provisions for decommissioning. The approved wind farm would consist of 14 wind turbines (13 at 126.5metres to blade tip and 1 wind turbine at 115.5metres to blade tip).

The current consultation relates to scoping request proceeding an anticipated Section 36 application for a development comprising the construction and operation of up to 12 wind turbines in the same locations as for the previously permitted development detailed above. The 12 proposed turbines would be 180.0metres to blade tip with a generation capacity of over 50MW. This scoping request has been assessed using the grid references listed below as provided in the Scoping opinion document:

Turbine	Easting	Northing
1	172,042	643,025
2	173,016	642,763
3	171,732	642,706
4	171,315	642,462
5	172,656	642,456
6	171,789	642,110
7	172,423	642,107

8	171,178	642,039
10	170,883	641,708
11	171,384	641,485
13	171,994	641,309
14	171,172	641,130

In the interests of air safety, the MOD will request that the development should be fitted with MOD accredited aviation safety lighting. The development should be lit in accordance with the requirements of the Air Navigation Order (ANO) 2016.

Defence Infrastructure Organisation Safeguarding wishes to be consulted and notified of the progression of planning applications and submissions relating to this proposal to verify that it will not adversely affect defence interests.

If the Section 36 application is granted, we would like to be advised of the following prior to commencement of construction;

- the date construction starts and ends;
- the maximum height of construction equipment;
- the latitude and longitude of every turbine.

This information is vital as it will be plotted on flying charts to make sure that military aircraft avoid this area.

If the application is altered in any way, we must be consulted again as even the slightest change could unacceptably affect us.

I hope this adequately explains our position on the matter. If you require further information or would like to discuss this matter further, please do not hesitate to contact me.

Further information about the effects of wind turbines on MOD interests can be obtained from the following websites:

***MOD*:** https://www.gov.uk/government/publications/wind-farms-ministry-of-defence-safeguarding

Yours sincerely

REDACTED

Miss Teena Oulaghan
Safeguarding Manager

A22

Edinburgh Airport - Consultation Response

REDACTED

From: Safe Guarding <safeguarding@edinburghairport.com>
Sent: 18 August 2020 11:11
To: Econsents Admin
Cc: Safe Guarding
Subject: Clachaig Glen - ECU00002103

Good morning,

In respect of the above, I can confirm the location of this development falls out with our Aerodrome Safeguarding zone therefore we have no objection/comment on this proposal.

With best regards,
Claire

Claire Brown | Safeguarding & Compliance Officer

Edinburgh Airport
Where Scotland meets the world

Edge | Empower | Expertise | Energy | Execute | External focus

Edinburgh Airport Limited
Airside Operations
Fire Station
Edinburgh
EH12 9DN Scotland

REDACTED

w: edinburghairport.com t: twitter.com/edi_airport

A23

Glasgow Airport - Consultation Response

REDACTED

From: #GLA Safeguarding <GLASafeguard@glasgowairport.com>
Sent: 04 August 2020 12:04
To: Brown C (Carolanne)
Subject: RE: Clachaig Glen Wind Farm proposal - scoping consultation

This proposal is located outwith our consultation zone. As such we have no comment to make and need not be consulted further

Kind regards
Kirsteen

GLASGOW AIRPORT
PROUD TO SERVE SCOTLAND

#GLA Safeguarding
#GLA Safeguarding

REDACT
glasafeguard@glasgowairport.com
www.glasgowairport.com

Glasgow Airport, Erskine Court, St Andrews Drive, Paisley, PA3 2TJ

CURRENT HOLDER OF FOLLOWING AWARDS
- Scottish Airport of the Year 2019
- Excellence in Transport Accessibility 2019

A24

From: Steve Thomson, Manager Air Traffic Services

To: Carolanne Brown, Energy Consents Unit
Econsents Admin

Date: 11 August 2020

RE: Clachaig Glen Wind Farm proposal - scoping consultation - response from Glasgow Prestwick Airport Ltd

Carolanne

We have reviewed the documents issued under the scoping consultation for Clachaig Windfarm – and make the following observations based purely on aviation issues.

1. It is likely that all proposed turbines will be terrain shielded from our primary radars – so Glasgow Prestwick Airport (GPA) ltd is unlikely to object from any concerns of turbine generated radar display clutter.

2. However we would like to be given the opportunity to be consulted again once a formal planning application is submitted – to allow more detailed Line of sight (LOS) analysis to be done once turbine locations and heights have been fully determined.

3. GPA may require an assessment to be undertaken by the Developer of the proposed windfarm against our published Instrument Flight Procedures (IFP's) (both conventional and RNAV) – to satisfy ourselves that the turbine tip heights have no impact on our existing published IFP's. This will be considered under further discussion with the developer if deemed necessary and appropriate.

4. Aviation lighting should be considered as part of formal EIA assessment.

5. GPA request to be consulted should this proposed development reach formal planning application stage.

With Kind Regards

Steve Thomson

Glasgow Prestwick Airport

Glasgow Prestwick Airport Ltd.
Aviation House
Prestwick
KA9 2PL
Scotland
United Kingdom

Steve Thomson
Manager Air Traffic Services
Glasgow Prestwick Airport Ltd.

REDACTED

www.glasgowprestwick.com

A25

HISTORIC ENVIRONMENT SCOTLAND | ÀRAINNEACHD EACHDRAIDHEIL ALBA

By email to: econsents_admin@gov.scot

Energy Consents Unit
4th Floor, 5 Atlantic Quay
150 Broomielaw
Glasgow
G2 8LU

Longmore House
Salisbury Place
Edinburgh
EH9 1SH

Enquiry Line: REDACTED
HMConsultations@hes.scot

Our case ID: 300021739
Your ref: ECU00002103

11 August 2020

Dear Sir/Madam

The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017
Clachaig Glen Wind Farm
Scoping Report

Thank you for your consultation which we received on 21 July 2020 about the above scoping report. We have reviewed the details in terms of our historic environment interests. This covers world heritage sites, scheduled monuments and their settings, category A-listed buildings and their settings, inventory gardens and designed landscapes, inventory battlefields and historic marine protected areas (HMPAs).

WOSAS will also be able to offer advice on the scope of the cultural heritage assessment. This may include heritage assets not covered by our interests, such as unscheduled archaeology, and category B- and C-listed buildings.

Proposed Development

We understand that the proposed development is for a 12-turbine windfarm on a consented 14 turbine site. The new proposal is to allow for more generating capacity (50MW more than previous scheme). The new proposal increases the blade tip height of the turbines to a maximum 180m, up from the 126.5m maximum tip height in the consented development.

The site is located approximately 20 kms to the North of Campbeltown and 1.8 km north east of the small hamlet of Muasdale on the western coast of the Kintyre Peninsula in Argyll and Bute.

Scope of assessment

While we can confirm that no heritage assets within our remit are located within the development site boundary, we consider that the proposals may give rise to impacts on the setting of a number of such heritage assets located within its vicinity.

Any Environmental Impact Assessment (EIA) undertaken for the proposals should therefore include an assessment of impacts on heritage assets and their settings.

We recommend that particular attention should be paid to the potential for impacts on the setting of the following heritage assets.

Scheduled Monuments

- Low Clachaig, cup marked boulders 915m E of (SM4352))
- North Beachmore, rock art panel 220m E, 350m E and 385m ESE of (SM13295)
- Dunan Muasdale, dun (SM3223)
- Killean,fort NE of (SM3179)
- St John's Church, church, burial ground and carved stones, Killean (SM3030)

A-Listed Buildings

- Killean, the "Dolls' Houses" (LB43266)
- Killean House (LB12005)

This list is not exhaustive, and we would recommend that the Zone of Theoretical Visibility (ZTV) analysis you provided with this Scoping Report is used to identify the assets for assessment. This form of analysis may be particularly helpful when the layout and massing of the windfarm proposals is established.

We recommend that this assessment is supported by visualisations such as photomontage and wireframe views where visual impacts are likely to be highest. This is likely to include visualisations of the windfarm proposals in views to and from the heritage assets identified above.

We also suggest that any cumulative impacts resulting from this development in combination with other existing and proposed developments within the surrounding area should be carefully considered.

EIA Scoping Report (July 2020)

We have reviewed the EIA Scoping Report (July 2020) submitted as part of this scoping request. We recommend that any EIA should include a detailed assessment of impacts on the setting of the heritage assets listed above as a minimum.

With regard to the methodology noted in the Scoping Report, we recommend that the criteria for determining the magnitude of impact, as set out in Table 12.2, is amended to reflect the EIA Handbook.

The report states that changes to the setting of an asset are considered with regard to our ability to understand and appreciate the asset. However, 'Managing Change in the Historic Envrionment: Setting' makes clear that setting can be important to the way in which historic assets are understood, appreciated and experienced. A consideration of how we experience an asset is important as it may, for example, help identify aspects of an asset's significance that are related to the character of its current surroundings, which could be affected by a proposed development.

We also recommend that the section on Mitigation Measures (12.37) be amended. This section notes that mitigation may include design interventions to avoid physical impacts. However, it does not acknowledge that design interventions may also be required to avoid or reduce impacts on the settings of assets.

We note that the Scoping Report proposes a flexible approach to the identification of high value assets on which there may be an impact upon setting. It states that the identification of potential impacts would be guided by the proposed development's ZTV and would also consider physical and historical connectivity and relationships with other heritage assets, designed views, and the wider landscape.

It is unclear how this approach would work in practice. For example, whether it would include consideration of views to assets when the asset itself was outside of the ZTV. Important views to an asset can be affected by proposed development even when views from the asset itself are unaffected. Because it is not clear to us how this approach would work in practice there is a risk that we would find it unacceptable. If an assessment were to be presented using a methodology that excluded assets from detailed assessment using a process we found unacceptable we would be likely to object the proposed development because of a lack of information.

Assets for our interest within and outside the ZTV up to at least 10km from the proposed development should be appraised for potential impacts on their settings. It is acceptable that assets which have no potential for adverse impacts on their settings are then excluded from detailed assessment. However, the rationale for this exclusion should be set out clearly in the assessment report. This would allow stakeholders to reach a view as to whether an asset's exclusion was reasonable or not.

Where potential for adverse impacts on an asset's setting are identified then that asset should be taken forward for detailed assessment to identify the scale of impacts. This is likely to require a site visit and, in some cases, production of visualisations. Both are likely to be required for several monuments in proximity to the proposed development, such as Dunan Muasdale, dun (SM3223) and Low Clachaig, cup marked boulders

HISTORIC ENVIRONMENT SCOTLAND | ÀRAINNEACHD EACHDRAIDHEIL ALBA

915m I of (SM4352). From an initial appraisal, significant impacts seem most likely to occur on the setting of these assets. Visualisations and site visits will help to inform a robust assessment of these potential impacts in the first instance. It may then be appropriate to mitigate impacts by design, through relocation, deletion or reduction in height of proposed turbines.

We would be happy to engage further with the applicant and confirm whether we were content with a proposed list of scheduled monuments for detailed assessment. This should be informed by a robust appraisal and the results and rationale behind the selection of monuments for detailed assessment clearly set out for us to review. We would also be able to provide further advice on what visualisations may be required from the selected monuments.

Further information
Guidance about national policy can be found in our 'Managing Change in the Historic Environment' series available online at www.historicenvironment.scot/advice-and-support/planning-and-guidance/legislation-and-guidance/managing-change-in-the-historic-environment-guidance-notes. Technical advice is available on our Technical Conservation website at http://conservation.historic-scotland.gov.uk/.
We hope this is helpful. Please contact us if you have any questions about this response. The officer managing this case is Chloe Porter and they can be contacted by phone on REDACTED or by email on chloe.porter@hes.scot.

Yours faithfully

Historic Environment Scotland

A29

Highlands & Islands Airport - Consultation Response

REDACTED

From: Safeguarding <Safeguarding@hial.co.uk>
Sent: 04 August 2020 14:48
To: Brown C (Carolanne); Econsents Admin
Subject: RE: Clachaig Glen Wind Farm proposal - scoping consultation

Follow Up Flag: Follow up
Flag Status: Flagged

Your Ref: ECU00002013
HIAL Ref: 2020/0140/CAL

Dear Sir/Madam,

PROPOSAL: SCOPING OPINION REQUEST– CLACHAIG GLEN WIND FARM PROPOSAL
LOCATION: Approximately 20km NE of Campbeltown Airport

This development falls within the safeguarded area, and lies directly adjacent to the direct arrival Instrument Flight Procedures (IFPs) for Campbeltown Airport (*as defined in CAP 764 – CAA Policy and Guidelines on Wind Turbines* and *CAP 738 – Safeguarding of Aerodromes*).

HIAL would require a flight procedure assesment to demonstrate that the IFPs will not be impacted by this development. Please note this assessment can only be conducted by ,and accepted from, an Approved Procedure Design Organisation, as approved by the CAA. The list of approved organisations can be found at the following link: https://www.caa.co.uk/Commercial-industry/Airports/Safety/Instrument-flight-procedures/Approved-procedure-design-organisations/

It should be noted that HIAL would work with the developer towards a resolution. However, HIAL are likely to **object to** any proposal which impacts on the Instrument Flight Procedures.

Regards,

Safeguarding Team
Highlands and Islands Airports Limited
Head Office, Inverness Airport, Inverness IV2 7JB
☏ REDACTED (DIRECT DIAL)
✉ safeguarding@hial.co.uk 🌎 www.hial.co.uk

A30

From: Rosie Simpson, John Muir Trust

To: Carolanne Brown, Energy Consents Unit

Date: 13 August 2020

RE: Clachaig Glen Wind Farm proposal - scoping consultation

Good Morning Carolanne,

Thank you for your email. I can advise that the John Muir Trust does not require an extension and that we do not have any comments to make at scoping stage. We have noted that this is an application to increase the size of the turbines at a site that was the subject of an application for a 12 turbine development which was approved in December 2019.

With best wishes,
Rosie

A31

From: JRC Windfarm Coordinations

To: Carolanne Brown, Energy Consents Unit

Date: 17 August 2020

Clachaig Glen Wind Farm proposal - scoping consultation [WF374481]

Dear Carolanne,

A Windfarms Team member has replied to your co-ordination request, reference **WF374481** with the following response:

Good Morning Carolanne,

Apologies, we have found this windfarm on our system from previous contact. It is still clear.

Kindest Regards,

Heather Willoughby

We hope this response has sufficiently answered your query.

Marine Scotland Science advice on freshwater and diadromous fish and fisheries in relation to onshore wind farm developments.

July 2020

Marine Scotland Science (MSS) provides internal, non-statutory, advice in relation to freshwater and diadromous fish and fisheries to the Scottish Government's Energy Consents Unit (ECU) for onshore wind farm developments in Scotland.

Atlantic salmon (*Salmo salar*), sea trout and brown trout (*Salmo trutta*) are of high economic value and conservation interest in Scotland and for which MSS has in-house expertise. Onshore wind farms are often located in upland areas where salmon and trout spawning and rearing grounds may also be found. MSS aims, through our provision of advice to ECU, to ensure that the construction and operation of these onshore developments do not have a detrimental impact on the freshwater life stages of these fish populations.

The Electricity Works (Environmental Impact Assessment) (EIA) (Scotland) Regulations (2017) state that the EIA must assess the direct and indirect significant effects of the proposed development on water and biodiversity, and in particular species (such as Atlantic salmon) and habitats protected under the EU Habitats Directive. Salmon and trout are listed as priority species of high conservation interest in the Scottish Biodiversity Index and support valuable recreational fisheries.

A good working relationship has been developed over the years between ECU and MSS, which ensures that these fish species are considered by ECU during all stages of the application process of onshore wind farm developments and are similarly considered during the construction and operation of future onshore wind farms. It is important that matters relating to freshwater and diadromous fish and fisheries, particularly salmon and trout, continue to be considered during the construction and operation of future onshore wind farms.

In the current document, MSS sets out a revised, more efficient approach to the provision of our advice, which utilises our generic scoping and monitoring programme guidelines (https://www2.gov.scot/Topics/marine/Salmon-Trout-Coarse/Freshwater/Research/onshoreren). This standing advice provides regulators (e.g. ECU, local planning authorities), developers and consultants with the information required at all stages of the application process for onshore wind farm developments, such that matters relating to freshwater and diadromous fish and fisheries are addressed in the same rigorous manner as is currently being carried out and continue to be fully in line with EIA regulations. At the request of ECU, MSS will still be able to provide further and/or bespoke advice relevant to freshwater and diadromous fish and fisheries e.g. site specific advice, at any stage of the application process for a proposed development, particularly where a development may be considered sensitive or contentious in nature.

MSS will continue undertaking research, identifying additional research requirements, and keep up to date with the latest published knowledge relating to the impacts of onshore wind farms on freshwater and diadromous fish populations. This

will be used to ensure that our guidelines and standing advice are based on the best available evidence and also to continue the publication of the relevant findings and knowledge to all stakeholders including regulators, developers and consultants.

MSS provision of advice to ECU

- MSS should not be asked for advice on pre application and application consultations (including screening, scoping, gate checks and EIA applications). Instead, the MSS scoping guidelines and standing advice (outlined below) should be provided to the developer as they set out what information should be included in the EIA report;
- if new issues arise which are not dealt with in our guidance or in our previous responses relating to respective developments, MSS can be asked to provide advice in relation to proposed mitigation measures and monitoring programmes which should be outlined in the EIA Report (further details below);
- if new issues arise which are not dealt with in our guidance or in our previous responses, MSS can be asked to provide advice on suitable wording, within a planning condition, to secure proposed monitoring programmes, should the development be granted consent;
- MSS cannot provide advice to developers or consultants, our advice is to ECU and/or other regulatory bodies.
- if ECU has identified specific issues during any part of the application process that the standing advice does not address, MSS should be contacted.

MSS Standing Advice for each stage of the EIA process

Scoping

MSS issued generic scoping guidelines (https://www2.gov.scot/Topics/marine/Salmon-Trout-Coarse/Freshwater/Research/onshoreren) which outline how fish populations can be impacted during the construction, operation and decommissioning of a wind farm development and informs developers as to what should be considered, in relation to freshwater and diadromous fish and fisheries, during the EIA process.

In addition to identifying the main watercourses and waterbodies within and downstream of the proposed development area, developers should identify and consider, at this early stage, any areas of Special Areas of Conservation where fish are a qualifying feature and proposed felling operations particularly in acid sensitive areas.

If a developer identifies new issues or has a technical query in respect of MSS generic scoping guidelines then ECU should be informed who will then co-ordinate a response from MSS.

Gate check

The detail within the generic scoping guidelines already provides sufficient information relating to water quality and salmon and trout populations for developers at this stage of the application.

Developers will be required to provide a gate check checklist (annex 1) in advance of their application submission which should signpost ECU to where all matters relevant to freshwater and diadromous fish and fisheries have been presented in the EIA report. Where matters have not been addressed or a different approach, to that specified in the advice, has been adopted the developer will be required to set out why.

EIA Report

MSS will focus on those developments which may be more sensitive and/or where there are known existing pressures on fish populations (https://www2.gov.scot/Topics/marine/Salmon-Trout-Coarse/fishreform/licence/status/Pressures). The generic scoping guidelines should ensure that the developer has addressed all matters relevant to freshwater and diadromous fish and fisheries and presented them in the appropriate chapters of the EIA report. Use of the gate check checklist should ensure that the EIA report contains the required information; the absence of such information may necessitate requesting additional information which may delay the process:

Developers should specifically discuss and assess potential impacts and appropriate mitigation measures associated with the following:

- any designated area, for which fish is a qualifying feature, within and/or downstream of the proposed development area;
- the presence of a large density of watercourses;
- the presence of large areas of deep peat deposits;
- known acidification problems and/or other existing pressures on fish populations in the area; and
- proposed felling operations.

Post-Consent Monitoring

MSS recommends that a water quality and fish population monitoring programme is carried out to ensure that the proposed mitigation measures are effective. A robust, strategically designed and site specific monitoring programme conducted before, during and after construction can help to identify any changes, should they occur, and assist in implementing rapid remediation before long term ecological impacts occur.

MSS has published guidance on survey/monitoring programmes associated with onshore wind farm developments (https://www2.gov.scot/Topics/marine/Salmon-Trout-Coarse/Freshwater/Research/onshoreren) which developers should follow when drawing up survey and/or monitoring programmes.

If a developer considers that such a monitoring programme is not required then a clear justification should be provided.

Planning Conditions

MSS advises that planning conditions are drawn up to ensure appropriate provision for mitigation measures and monitoring programmes, should the development be given consent. We recommend, where required, that a Water Quality Monitoring Programme, Fisheries Monitoring Programme and the appointment of an Ecological Clerk of Works, specifically in overseeing the above monitoring programmes, is outlined within these conditions and that MSS is consulted on these programmes.

Wording suggested by MSS in relation to water quality, fish populations and fisheries for incorporation into planning consents:

1. No development shall commence unless a Water Quality and Fish Monitoring Plan (WQFMP) has been submitted to and approved in writing by the Planning Authority in consultation with Marine Scotland Science and any such other advisors or organisations.

2. The WQFMP must take account of the Scottish Government's Marine Scotland Science's guidelines and standing advice and shall include:

    a. water quality sampling should be carried out at least 12 months prior to construction commencing, during construction and for at least 12 months after construction is complete. The water quality monitoring plan should include key hydrochemical parameters, turbidity, and flow data, the identification of sampling locations (including control sites), frequency of sampling, sampling methodology, data analysis and reporting etc.;
    b. the fish monitoring plan should include fully quantitative electrofishing surveys at sites potentially impacted and at control sites for at least 12 months before construction commences, during construction and for at least 12 months after construction is completed to detect any changes in fish populations; and
    c. appropriate site specific mitigation measures detailed in the Environmental Impact Assessment and in agreement with the Planning Authority and Marine Scotland Science.

3. Thereafter, the WQFMP shall be implemented within the timescales set out to the satisfaction of the Planning Authority in consultation with Marine Scotland Science and the results of such monitoring shall be submitted to the Planning Authority on a 6 monthly basis or on request.

Reason: To ensure no deterioration of water quality and to protect fish populations within and downstream of the development area.

Sources of further information

Scottish Natural Heritage (SNH) guidance on wind farm developments - https://www.nature.scot/professional-advice/planning-and-development/advice-planners-and-developers/renewable-energy-development/onshore-wind-energy/advice-wind-farm

Scottish Environment Protection Agency (SEPA) guidance on wind farm developments – https://www.sepa.org.uk/environment/energy/renewable/#wind

A joint publication by Scottish Renewables, SNH, SEPA, Forestry Commission Scotland, Historic Environment Scotland, MSS and Association of Environmental and Ecological Clerks of Works (2019) Good Practice during Wind Farm Construction - https://www.nature.scot/guidance-good-practice-during-wind-farm-construction.

A37

NATS Safeguarding - Consultation Response

REDACTED

From: NATS Safeguarding <NATSSafeguarding@nats.co.uk>
Sent: 30 July 2020 08:41
To: Brown C (Carolanne)
Cc: NATS Safeguarding; Econsents Admin
Subject: RE: Clachaig Glen Wind Farm proposal - scoping consultation (SG20022)

Follow Up Flag: Follow up
Flag Status: Flagged

Our Ref: SG20022

Dear Carolanne

The proposed development has been examined from a technical safeguarding aspect and does not conflict with our safeguarding criteria. Accordingly, NATS (En Route) Public Limited Company ("NERL") has no safeguarding objection to the proposal.

However, please be aware that this response applies specifically to the above consultation and only reflects the position of NATS (that is responsible for the management of en route air traffic) based on the information supplied at the time of this application. This letter does not provide any indication of the position of any other party, whether they be an airport, airspace user or otherwise. It remains your responsibility to ensure that all the appropriate consultees are properly consulted.

If any changes are proposed to the information supplied to NATS in regard to this application which become the basis of a revised, amended or further application for approval, then as a statutory consultee NERL requires that it be further consulted on any such changes prior to any planning permission or any consent being granted.

Yours faithfully

NATS Safeguarding

E: natssafeguarding@nats.co.uk

4000 Parkway, Whiteley,
Fareham, Hants PO15 7FL
www.nats.co.uk

A38

NatureScot
Scotland's Nature Agency
Buidheann Nàdair na h-Alba

Energy Consents Unit
Scottish Government

By email only to: econsents_admin@gov.scot

04 September 2020

Our ref: CEA159942

Your ref: ECU00002103

Dear Sir / Madam,

THE ELECTRICITY ACT 1989
THE ELECTRICITY WORKS (ENVIRONMENTAL IMPACT ASSESSMENT) (SCOTLAND) REGULATIONS 2017
SCOPING OPINION REQUEST – PROPOSED CLACHAIG GLEN WIND FARM, ARGYLL & BUTE

Thank you for your consultation request dated the 21st July 2020 requesting comments on the scope of the Environmental Impact Assessment (EIA) for the proposed Clachaig Glen Wind Farm (hereafter referred to as the 'Proposal').

Consent was granted for Clachaig Glen Wind Farm which consisted of 14 turbines with maximum tip heights of up to 126.5 m in 2019, following an appeal to Scottish Ministers ('the Consented Scheme'). The Proposal now seeks to increase the maximum tip height of the turbines is 180 m whilst reducing the number of turbines to 12. It is understood that the locations of the turbines will remain as per the Consented Scheme with turbines 9 and 12 now being removed from the layout. The majority of infrastructure will largely remain in the same location and at the same scale as the Consented Scheme with the exception of larger turbine foundations, the addition of onsite battery storage and access track widening to accommodate larger turbine components.

1. Summary

We consider that the key considerations of interest to NatureScot to be addressed in detail as part of the EIA process include:

- Landscape and visual, including potentially significant concerns regarding the potential individual, and cumulative landscape and visual effects of the Proposal in this location.
- Ornithological impacts; including impacts on Schedule 1 bird species.

Our initial advice, based on our current understanding of the Proposal is that it is located in a very sensitive location which may give rise to natural heritage concerns which could prove difficult to overcome. As such, there is a possibility that we may object to an application for permission to build a wind farm of this scale in this location. These comments are made without prejudice to any future planning application.

2. Our Advice

2.1. Landscape and Visual

The Proposal is located on land approximately 1.8 kilometres (km) north east of Muasdale on the west coast of Kintyre. At 180 metres to blade tip, the proposed turbines are significantly taller than the current operational wind farms in the vicinity of the Proposal (Deucheran Hill: 76 m tip height and Auchadaduie: 76 m tip height). This Proposal, due to its height, would also introduce the effects of turbine lighting to this area.

We consider there would be a number of issues with this Proposal that we think would benefit from further discussion, these aspects concern the potential for adverse effects, the capacity of the landscape to accommodate this scale of proposal, looking at both day and night time effects due to aviation lighting.

We are supportive of the principle of renewable energy, however, we wish to advise at this initial consultation, and without prejudice to any future advice, that we have **significant concerns regarding the potential individual, and cumulative landscape and visual effects of the Proposal in this location.**

Given the sensitivities, both individually and cumulatively, we consider it would be extremely difficult to accommodate the proposed wind farm development in this location. As such, we do not consider this to be an appropriate location for wind energy development of this scale.

There is a possibility that we would object to an application for permission to build a wind farm of this scale in this location. These comments are made without prejudice to any future planning application.

We advise that the applicant may wish to explore a reduction in scale (both height and number of turbines), to address the landscape and visual sensitivities (informed by the Landscape Wind Energy Capacity Study (LWECS)), minimising cumulative effects with the adjacent wind farms, and avoiding the adverse effects of lighting as part of the iterative design process.

Please see **Annex 1** for further advice on the landscape and visual aspects of this Proposal.

2.2. Ecology

We understand that the Proposal site has been subject to ecological surveys in 2013 and 2015/2016 and that the proposed 2020 field surveys will be undertaken to confirm that the baseline habitats have not been altered since the previous surveys and to update protected species usage of the site for otter, water vole, badger, pine marten and bats.

Whilst it is acknowledged that the access route will utilise the existing forestry tracks, upgrade works are likely to be required to accommodate larger turbine components associated with the Proposal. This could result in a loss of protected habitats or disturbance to protected species and their resting / breeding places and, as such, the proposed access route should be surveyed appropriately.

We are content with the proposed scope of surveys and assessment of the key ecological receptors identified in the Scoping Report. We also request that the EIA Report includes a summary of any data gaps or limitations in fieldwork due to Covid-19 restrictions.

2.3. Ornithology

The Applicant has previously consulted with NatureScot in May 2020 with regards to the validity of the existing ornithological survey data for the Proposal and a summary of our advice is provided in paragraph 10.5 of Chapter 10 of the Scoping Report.

We are content with the proposed scope of surveys and assessment of the key ornithological receptors identified in the Scoping Report and request that the EIA Report includes a summary of any data gaps or limitations in fieldwork due to Covid-19 restrictions.

2.4. Peat

We understand that Phase 1 and 2 peat probing surveys were undertaken to inform the layout of the Consented Scheme in 2013 and 2016. As the majority of the infrastructure layout will remain largely the same as the Consented Scheme, it is not proposed to repeat peat surveys. However, the Applicant should ensure that any locations of new infrastructure i.e. battery storage and areas of track that require widening, should be sufficiently surveyed for deep peat if they were out with the survey area in 2013 or 2016.

2.5. General Scoping Advice

We refer the Applicant to our '*general scoping and pre-application advice*' note[1] which provides advice on other considerations which should be taken into account in the EIA Report. When formatting the EIA Report for submission, we wish to highlight the following requirements:

- For ease of use, text chapters and appendices of EIA Report should be presented on A4 paper (rather than A3);
- Landscape figures to be provided in a ring binder (rather than being spiral or otherwise bound), for ease of use during site visits; and
- **A full hard copy of the landscape figures should be sent directly to the SNH case officer** – all other supporting information can be electronic but please ensure that file sizes are <10MB per pdf.
- **Ensure that electronic file names clearly indicate their content (e.g. Clachaig Glen Wind Farm - LVIA Figure 6.2a – VP2 North Muasdale).**

3. Conclusion

Whilst we are supportive of the principle of renewable energy, our advice is given without prejudice to a full and detailed consideration of the impacts of the Proposal if it is submitted as a formal application.

Please do not hesitate to contact me should you have any queries on our advice above.

Yours sincerely,

[by email]

Catriona Laird
Area Officer – Argyll and Outer Hebrides
Catriona.laird@nature.scot

[1] General pre-application and scoping advice for onshore wind farms (2020). https://www.nature.scot/general-pre-application-and-scoping-advice-onshore-wind-farms

Annex 1 – Detailed Landscape and Visual Advice

1. Landscape Wind Energy Capacity Study (LWECS) 2017

In our view, the Proposal is not supported by the development recommendations cited in the Argyll & Bute Landscape Wind Energy Capacity Study 2017[2]. This report states that "there is no scope for wind turbines >150m to be accommodated in Argyll and Bute." The LWECS was jointly commissioned by Argyll & Bute Council and SNH to inform strategic planning and provide guidance on constraints and opportunities for wind energy development to help secure good quality renewables development in appropriate locations. We advise that the study is considered fully, taking into account adjacent Landscape Character Types (LCTs) impacted by the proposal as well as the receiving LCT. This report is a material consideration.

2. Scope of Landscape and Visual Assessment

2.1 Visual Assessment

It is acknowledged that visual assessment will be based on the 17 viewpoints which were used to inform the previous LVIA for Clachaig Glen Wind Farm in 2016 and are detailed in Table 7.1 of the Scoping Report.

We disagree that photomontages would not be supplied from viewpoints at distances greater than 10 km as stated in the Scoping Report as this is contrary to our guidance[3] (paragraph 160). This distance was originally proposed when turbines were a lot smaller and therefore pixilation would occur due to the smaller size with distance, however, we now consider that turbines up to 20 km away should be montaged, and for this Proposal it may be possible for them to be produced from an even greater distance given the number of turbines and heights proposed.

We would be happy to provide further comment on viewpoints on receipt of appropriate supporting information, including:

- Blade tip ZTV on a more detailed OS base map (AO scale) with viewpoint locations in accordance with our guidance;
- ZTV with designations and viewpoints;
- Further justification of the viewpoint selection including designation, landscape character type, receptor type etc.; and
- Draft wirelines would also be helpful.

While we welcome the draft viewpoint selection, our comments are limited in the absence of the above information. We advise (based on a desk based study) that there are some serious viewpoint omissions and additional viewpoints should be explored and considered for assessment viewpoints. Should omissions become apparent at EIAR stage, we may request further viewpoint information.

Some initial suggestions for additional LVIA assessment viewpoints to explore include representative views from:

- Water-based viewpoints to represent boats / recreational watercraft in the Kilbrannan Sound;
- Gigha South Pier – we disagree that this view is less sensitive than VP15 – Ardminish and suggest that it is retained;

[2] Argyll and Bute Landscape Wind Energy Capacity Study – 2017. Available online at: https://www.argyll-bute.gov.uk/planning-and-environment/landscape-wind-energy-capacity-study

[3] SNH (2017). Visual Representation of Wind Farms, Version. 2.2: https://www.nature.scot/visual-representation-wind-farms-guidance

- Kennacraig – Port Ellen Ferry – the views of the Proposal from the Kennacraig – Port Ellen ferry will be markedly different to that of the Kennacraig to Port Askaig ferry and therefore we suggest that this VP is retained;
- Dun Skeig – a hill fort and popular walk with elevated panoramic views;
- The Kintyre Way Long Distance Route between Rhunahoarine and Tayinloan;
- Nearby settlements (e.g. Glenbarr, Tayinloan);
- Machrihanish;
- An additional low elevation VP from within the North Arran NSA i.e. Catacoll or Lochranza;
- Additional elevated viewpoints from North Arran WLA to inform the wild land assessment and to illustrate potential effects from the interior of the North Arran WLA e.g. Beinn Tarsuinn; and
- Jura NSA e.g. Craighouse – given the distance, a wireline is likely to be acceptable in this case.

It is noted that baseline photography is not proposed for VP30 – A83 (BT Car Park) and a wireline is proposed instead. We disagree with this approach as the car park is separated from the A83 by a large grass verge and it is possible to park a vehicle safely away from the A83.

We note that existing baseline photography from the 2016 ES and 2019 public inquiry will be used to inform the LVIA for this Proposal. The Applicant must ensure that the baseline views from the proposed VPs have not changed significantly since the original photography was undertaken.

2.2 Landscape Character Study Area

LCT boundaries should be as defined in the LWECS 2017 and other current wind capacity studies. Seascape should include all potentially significantly affected waterscapes.

We wish to highlight the sensitivity of the Coastal Plains landscape character type (LCT) – this is the only occurrence of this LCT in the region and is small in extent. It is currently unaffected by wind energy development. Furthermore it is valued by people for recreation including the promoted Kintyre Way along the shore, the popular / camp holiday park and the jetty for Gigha ferry.

The Proposal should also carefully consider the sensitivity of the Rocky Mosaic LCT to this type and scale of wind farm development.

2.3 Designated Landscapes

Given the distance between the Proposal and the Jura Wild Land Area (WLA), we are content for a separate assessment wild land assessment to be scoped out for this designation. However, given the significant increase in tip height and the addition of aviation lighting requirement, we recommend that a wild land assessment is undertaken for the North Arran WLA.

2.3.1 North Arran Wild Land Area

North Arran WLA is a small WLA with a limited number of wild land qualities as highlighted in the Description. The ZTV submitted for this Proposal indicates visibility across the WLA including the interior where wild land qualities are well expressed. Given some of the qualities could potentially be adversely affected by the proposed development, we advise that the full extent of the WLA and the following wild land qualities should be considered in the wild land assessment:

- A readily accessible area, but with strong wild land attributes, especially within the remote interior; and
- The contrast in experience between the rugged east and smoother and more remote west mountain ranges

The qualities of the WLA have been set out within the WLA Description. These qualities draw together the combination of wild land attributes where they are strongly expressed and contribute to the overall high sense of wildness across this WLA.

There may have been changes to the baseline since the identification of the WLA in 2014. This should be checked through fieldwork and details of proposals can be obtained from the relevant determining authorities. It will be important to establish the current assessment baseline. An extract from our Guidance below expands on this:

"16. When reviewing the baseline, the strength of attributes and responses and their contribution to the wild land qualities of the area should be confirmed, taking in to account any changes that may have occurred either within or outwith the WLA since the mapping and descriptions were produced. Changes should only be referenced if individually or collectively they affect the appreciation of wild land qualities.

17. The WLA descriptions are important for understanding the baseline condition of the WLAs along with the desk-based mapping work on SNH's 'Mapping Scotland's Wild Land Areas' web page. The assessor will need to augment these with fieldwork."

We would like to emphasise the need to consider how people move through the area, with a focus on the effect on the wild land qualities and their experiential nature. We recommend the use of 'assessment points' to record, in the field, the likely effects on the experience of the wild land qualities while moving through the WLA. A wider understanding of movement through the area could be gained from literature and websites including, for example, www.walkhighlands.co.uk.

2.4 Cumulative Assessment

The Cumulative Base Plan should be to a 60 km radius unless a reduced radius is justified and agreed. We recommend also including consideration of small scale proposals (50 m or less) within a 20 km radius. The focus of the assessment should be on potential significant cumulative interactions. The sites to be included in the Cumulative Landscape and Visual Impact Assessment (CLVIA) should be agreed with Argyll and But Council. The assessment process should be in accordance with SNH Guidance[4].

2.5 Cumulative Issues of Scale, Design and Layout

The scale of the proposed turbines is significantly larger than other wind farms on Kintyre including the nearby operational Deucheran Hill and Auchadaduie wind farms and the consented Blary Hill wind farm (up to 110 m). This may give rise to significant design issues and exacerbate cumulative effects with other wind farms in the area. It will also increase visual prominence from key views from highly sensitive receptors including roads, recreational routes and settlements.

2.6 Aviation Lighting

We note that turbines of 150 m or taller may require visible lighting[5]. We advise that there is a need for a lighting impact assessment wherever this is the case, as identified in the Scoping Report.

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[4] SNH (2012). Assessing the cumulative impact of onshore wind energy developments. https://www.nature.scot/guidance-assessing-cumulative-impact-onshore-wind-energy-developments

[5] The requirement for aviation lighting is set out in Civil Aviation Authority (CAA) guidance – see http://www.caa.co.uk/Safety-Initiatives-and-Resources/Safety-projects/Windfarms/Windfarms/ and http://publicapps.caa.co.uk/docs/33/CAP764%20Issue6%20FINAL%20Feb.pdf. All onshore wind turbines of over 150m require steady red aviation lights. The requirements offshore are slightly different and are set out the same CAA guidance. Some wind turbines of less than 150 m may also require aviation lights depending on location and proximity to both civil and military aviation interests.

The assessment of aviation lighting effects will be of critical importance to this Proposal. We advise that the lighting assessment should include night-time visualisations from a range of receptors; representative of both low elevation e.g. the coast and high elevation from key hills. We also recommend that the assessment considers a representative viewpoint located at an appropriately selected location within the North Arran WLA.

The turbine lighting assessment should consider the cumulative effects of lights from any other consented or application stage schemes if relevant. The proposed lighting of any cumulative schemes should also be illustrated on all the night time photomontages. If directional lighting is to be employed as a form of mitigation, then it would also be useful to include a lighting intensity ZTV within the assessment (this ZTV should also show the boundaries for the Wild Land Area). We recognise that a range of mitigation options for lighting may be available, and would encourage the Applicant to explore these prior to the submission of the Section 36 Application.

Night time ZTV and visualisations should be provided in accordance with our guidance. The landscape and visual assessment of turbine lighting should be informed by the scoping advice at Annex 2 of our recently updated 'General Scoping and Pre-Application Advice' document[1].

Since receiving the Scoping Report, we have arranged a meeting with the Applicant to discuss the aviation lighting requirements of this Proposal and note that that night time visualisations are currently proposed to be undertaken from Rhunahoarine and Ardminish.

2.7 Associated Infrastructure

All ancillary infrastructure, should be visualised / described when likely to be visible.

2.8 Site Access

Proposed access arrangements could present a significant change to the landscape character at the site entrance; removal of mature trees are likely to be required and a large sweep for access would need to be created. We advise that access creation would have a significant localised effect and a sequential cumulative effect with the access for other wind farm schemes off the A83.

When considering access formation for proposals that are consented and in the planning system, then there is potential for four or five engineered access ways off the A83. If these are not sensitively designed and restored then they could have a longer-term significant sequential landscape and visual cumulative effect along the A83 route through the Rocky Mosaic LCT between the Whitehouse and the Glenbarr area.

2.9 Landscape and Cultural Heritage

The Cultural Heritage section should be cross-referenced with the Landscape section of the EIAR with representative assessment viewpoints and assessment of the effects of the proposal on the views and experience of the landscape; in particular the effect on historic character as it contributes to landscape experience.

A45

giving nature a home
rspb Scotland

Energy Consents and Deployment Unit
5 Atlantic Quay
150 Broomielaw
Glasgow G2 8LU

Econsents_Admin@gov.scot.

31 August 2020

Dear Sir/Madam

ELECTRICITY ACT 1989
THE ELECTRICITY WORKS (ENVIRONMENTAL IMPACT ASSESSMENT) (SCOTLAND) REGULATIONS 2017

SCOPING OPINION REQUEST– CLACHAIG GLEN WIND FARM PROPOSAL, ARGYLL & BUTE

Thank you for consulting RSPB Scotland regarding this scoping opinion for this wind farm of 12 turbines with a blade tip height of up to 180m plus associated infrastructure by RWE Renewables UK Developments Ltd. This is an adaption of a smaller-scale consented proposal - the site boundary and turbine locations of the 'Proposed Development' are largely identical with only minimal changes proposed to onsite infrastructure; but seeks an increased operational period of 35 years. It is situated within Kintyre, an area in which the land use is dominated by commercial forestry and windfarms. The proposed site is managed by Forest and land Scotland (FLS) and although the dominant land use within the site is forestry, there are large areas of open ground to the north-west and a higher ridge in the east with smaller areas of peat habitat left unplanted.

RSPB Scotland advises that this proposal has potential to impact on a number of species of birds of conservation concern, particularly, Greenland-white-fronted goose (GWFG), golden eagle, red throated diver, hen harrier, merlin, peregrine and black grouse. We had concerns that impacts of the previous scheme were underestimated and advised that turbines T1, T3 and T4 were relocated and that habitat management is undertaken to restore peatland and native woodland, to minimise the carbon impact of the development and mitigate for biodiversity impacts. We reiterate these concerns - *we recommend that turbines T1 and T3 are moved eastwards from open ground / blanket bog and are sited within the forestry and that turbine T4 is moved from the edge further into the forestry. This would minimise potential collision by hen harriers and kestrel, reduce habitat loss to golden eagles as well as reducing loss of blanket bog and carbon impacts. NB. borrow pits should be all be on areas of existing forestry rather than impact further on open ground habitats.*

Given the statutory duty of the landowner to promote biodiversity, it was particularly disappointing that more consideration was not given to deliver for biodiversity through peatland restoration as well as native woodland planting.

South and West Scotland Regional Office
10 Park Quadrant
Glasgow
G3 6BS

Tel 0141 331 0993
Fax 0141 331 9080

rspb.org.uk

BirdLife INTERNATIONAL

RSPB Scotland is supportive of the use of renewable energy but believes that wind farms must be carefully sited to avoid negative impacts on sites and species of conservation importance.

EIA Considerations and Proposed Methodology
The survey periods were 2014 – 2016 and further ornithology survey for the revised proposal was undertaken in in 2018 – 19. We advise that this later work should include two breeding seasons and that monitoring for any key species should ideally be continued up to and through the application process – with data made available up to the nearest breeding season to inform the ES. All survey work should apply / follow the latest guidance from SNH as a minimum requirement – i.e. a full assessment of impacts for all priority species including revised collision risk modelling.

It is unclear if survey work for priority species has continued through 2020 and if so it may be compromised by the Covid-19 virus outbreak. We would expect to see justification / analysis of this missed survey period / data. We also advise that applying standard guidance for two years survey will ensure there is at least one full breeding season of more standard data for comparison.

We would advise that ideally all turbines are placed *c*.500m into the forestry so as to reduce potential displacement for bird species such as golden eagle. This was ignored by the previous scheme please see more detailed comments.

Golden eagles
This area is currently occupied by territorial birds which utilise suitable habitat within the area and it is a key priority for assessment. The previous application showed that collision risk for the species was found to be high (in relation to similar developments elsewhere in Argyll), with a loss of 2.2 birds predicted over the lifetime of the windfarm. There is a need to fully understand usage (nest and foraging) within this area and we would advise that further modelling (PAT & GET) and more detailed studies should ideally be undertaken above that recommended within standard guidance.

Note - We advise that in order to mitigate potential impacts, the open ground should be managed positively for eagles; turbines should be sited within the forestry, and low density native forestry and opportunities for peatland restoration are funded through a Habitat Management Plan (HMP). We advise relocating turbines T1, T3 and T4 to maintain a robust foraging area for eagles on the western side of the wind farm.

Greenland white-fronted geese
Previous survey work showed that flights focus upon the two lochans to the south of the turbines with a focus on the route between the two lochs - over 1km from the nearest turbine. Recent survey work should confirm whether this usage pattern remains or if any changes have occurred. A Habitats Regulations Appraisal (HRA) in regards to the Kintyre Goose Roosts SPA will be required if survey work shows usage of the turbine envelope.

Hen harrier & other raptors
In regards hen harrier, we would advise that the potential future use of the restructured forestry and open ground around turbines requires careful consideration since draw-in of birds into these areas and collision are distinct possibilities. It was clear from the original application that hen harriers nest close to and forage within the area. Although collision was predicted as low, flightlines showed usage over a large extent of the site - with a focus then on the open ground to the north west in which turbines T1 and T3 are sited. This part of the site is also heavily used by kestrel which are susceptible to collisions. Relocating these turbines seems to be an obvious mitigation measure.

Red-throated diver
The original survey work shows few flights recorded through the turbine envelope. It is unclear if birds bred successfully within that survey period on the surrounding lochans and no attempt was made to establish their main flightlines. Flights through the site tend to suggest both direct flights between sea and lochans and also between lochans. The situation needs to be updated using recent survey information. We advise 500m as a minimum set back distance. Cumulative impacts should be considered, along with wider safeguarding measures for Argyll diver populations.

Black grouse
Black grouse occur within the area however we hold no recent data for this area. **We advise that turbines should not be located within 500m of known lek sites.** Positive mitigation / management for this species should be undertaken as part of a Habitat Management Plan (HMP).

Peatland Impacts
Being predominantly coniferous forestry, the SNH Peatlands map shows the site as class 5 which is already impacted due to forestry. However, consideration of peat depths is vitally important to avoid deep peat and so a detailed peat mapping exercise is required. The design process should ensure peat impacts are avoided and should promote opportunities for restoration and positive management. Borrow pits should be located in areas where peat/open habitats are already impacted from forestry and turbines relocated from open blanket bog into areas modified by forestry.

Carbon calculations for the proposal should be based on the latest version of the Scottish Government's carbon calculator and should clearly show the carbon payback period for the proposed scheme.

Habitat Management/Mitigation – Including Forestry Compensatory Planting
The EIA should include details of proposals for mitigation/enhancement in relation to priority habitats and species. We would expect mitigation to include timing constraints for construction works (visual/noise) to avoid sensitive breeding periods. Consideration should also be given to use of any works-related lighting. Given aviation lighting is required, the impacts of this should be assessed and requirement for operational mitigation considered.

We would welcome the restoration of suitable areas to bog/peatland habitat and would expect that this represents an opportunity for low density planting of native tree species in suitable areas to benefit biodiversity. This would help to deliver benefits for priority species (golden eagles, black grouse etc) as well as achieving aims within the Argyll and Bute Woodland and Forestry. Ideally, any compensatory planting should be included as part of the EIA. A detailed HMP should be submitted with any application and should include detailed ecological justification for any proposals.

We ask that as a minimum an indicative grid connector route is included at the application stage.

Cumulative Impacts
An assessment of cumulative bird impacts in relation to other consented project or developments in the planning system within this NHZ should be undertaken (in accordance with SNH guidance 'Assessing the Cumulative Effects of Onshore Wind Energy Developments' 2012). We also advise that land use in Kintyre is becoming dominated by windfarms and forestry and so the need to consider cumulative impacts is paramount in relation to land use change. Furthermore, detailed survey work may be required if the work undertaken highlights issues that merit further consideration.

We hope you find these comments helpful. Should you require clarification of any of the above points please do not hesitate to contact me.

Yours faithfully
Redacted

Senior Conservation Officer, Argyll, arran and Ardnamurchan

cc. Louise Gunstensen, RSPB Senior Conservation Planner

A48

From: Elaine Jamieson, Scottish Forestry

To: Carolanne Brown, Energy Consents Unit

Date: 31 August 2020

Clachaig Glen Wind Farm proposal - scoping consultation

Hi Carolanne,

Please find attached our scoping Opinion for the above proposal.

I would be pleased to meet the developers and their woodland advisors as soon as possible to discuss the scope of the Wind Farm Forest Plan.

Regards
Elaine

Elaine Jamieson
Operations and Development Officer
Scottish Forestry

Perth & Argyll Conservancy | Upper Battleby, Redgorton | Perth | PH1 3EN

elaine.jamieson@forestry.gov.scot

forestry.gov.scot
@scotforestry

Scottish Forestry / Coilltearachd na h-Alba

Scottish Forestry is the Scottish Government agency responsible for forestry policy, support and regulation.

Scottish Forestry

Scoping Opinion –Clachaig Wind farm Proposal -31.8.20

Forestry and Woodlands

Scotland's forests make a substantial contribution to the economy at both national and local levels, they provide considerable environmental benefits and help to improve people's quality of life. The Scottish Government aims to maintain and enhance Scotland's forest and woodland resources for the benefit of current and future generations. To achieve this, we need to prevent inappropriate woodland losses (Scotland's Forestry Strategy, 2019).

The third National Planning Framework also recognises that Scotland's woodlands and forestry are an economic resource, as well as an environmental asset. The Climate Change Plan places emphasis on the fact that Scotland's woodlands deliver a wide range of benefits, including inward investment and jobs, climate change adaptation and mitigation, and the enhancement of the health and well-being of Scotland's communities. The Scottish forestry sector is worth almost £1 billion per year and employs over 25,000 people.

There is therefore a strong presumption in favour of protecting Scotland's woodland resources and the Scottish Government provides policy direction in the policy on control of woodland removal. Woodland removal should be kept to a minimum and where woodland is felled it should be replanted. The policy supports woodland removal only where it would achieve significant and clearly defined additional public benefits. In some cases, including those associated with development, a proposal for compensatory planting may form part of this balance.

The criteria for determining the acceptability of woodland removal is explained in the policy and the applicant should take them into account when preparing the proposal. Beyond this, the applicant should refer to guidance documents issued by Scottish Forestry (and previously by Forestry Commission- FC) in relation to good forestry practice and sustainable forest management.

Woodland Management and tree felling
Where woodland removal is proposed for development, the relevant Environmental Impact Assessment (EIA) regulations will apply and the EIA Report should justify and provide evidence for the need for woodland removal and the associated mitigation measures.

The first consideration for the applicant should be whether the underlying purpose of the proposal can reasonably be met without resorting to woodland removal. Design approaches that reduce the scale of felling required to facilitate the development must be considered and integration of the development with the existing woodland structure is a key part of the consenting process.

Integration of the project into future forest design plans is a key part of the development process. **The removal of large areas of woodland will not be supported.** When a proposed development or infrastructure requires to go through forestry, consideration should be given to forest design guidelines.
The EIA Report should include a stand-alone chapter on 'Woodland management and tree felling' (a forest plan) prepared by a suitably qualified professional and supported by existing records, site surveys and aerial photographs. In order to present the relevant information about the forest and to secure compliance with the UK Forestry Standard, the applicant should consider the appropriate scope/scale for such plan.

In certain cases a forest plan of the proposed development area only is not appropriate. The applicant should consider the whole ownership, or multiple ownerships, or expands the scope of the forest plan so that to present the relevant information about that forest. Details of the proposed mitigation measures must be included in the EIA Report, not left to post-consent habitat management plans (or others) to decide and implement.

The chapter should describe and recognise the social, economic and environmental values of the forest and the woodland habitat and take into account the fact that, once mature, the forest would have been managed into a subsequent rotation, often through a restructuring (re-designing) proposal, according to the UK Forestry Standard, that would have increased the diversity of tree species and the landscape design of the forest.

The chapter should describe the baseline conditions of the forest, including its ownership. This will include information on species composition, age class structure, yield class and other relevant crop information. The chapter should describe the changes to the forest structure, the woodland composition and describe the work programme:

- the proposed areas of woodland for felling to accommodate the proposed infrastructures, including access roads, tracks, underground pipes and cables and any ancillary structures. Details of the area to be cleared around those structures should also be provided, along with evidence to support the proposed scale and phasing of felling;

- trees felled must be replanted on-site or compensated for (off-site planting) and these areas must be clearly identified in the plan. On-site replanting must always be considered first. The replanting operations must be appropriately described, including changes to the species composition, age class structure, timber production and traffic movements. Tree/shrub species must be suited to the site and the objectives of management;

- areas of open ground in the forest that are designed for biodiversity or landscape enhancement or for recreation opportunities should not be considered for on-site replanting (to compensate for woodland removal in other parts of the forest).

The applicant should consider the potential cumulative impact of existing and the proposed development on the forest resource in respect to the local and regional context. In particular consideration must be given to the implication of felling operations on such things as habitat connectivity, biodiversity, water management, landscape impact, impact on timber transport network and forestry policies included in the local and regional Forestry and Woodland Strategies and local development plans.

A long term forest plan should be provided as part of the EIA Report (as a technical appendix for context) to give a strategic vision to deliver environmental and social benefits through sustainable forest management and describes the major forest operations over a 20 years period.

UK Forestry Standard

The UK Forestry Standard is the Government's reference standard for sustainable forest management in the UK and provides a basis for regulation and monitoring. The Scottish Government expects all forestry plans and operations in Scotland to comply with the standards. Both felling operations and on and off-site compensatory planting must be carried out in accordance to good forestry practice- the EIA Report must clearly state that the project will be developed and implemented in accordance with the standard. A key component of this is to ensure that even-age woodlands are progressively restructured in a sustainable manner: felling coupes should be phased to meet adjacency requirements and their size should be of a scale which is appropriate in the context of the surrounding woodland environment.

Scottish Forestry

On the 1st of April 2019 Forestry Commission Scotland transferred into a new agency of Scottish Government called Scottish Forestry, responsible for forestry policy, support and regulation.

Scottish Forestry is the main forestry consultee and should be consulted throughout the development of the proposal to ensure that proposed changes to the woodland are appropriate and address the requirements of policy on control of woodland removal and the principles of sustainable forest management.

It is important that pre-application discussions takes place with the local Scottish Forestry Conservancy office, the planning authority and other relevant key agencies, at the earliest possible stage of the project, to ensure all parties have a shared understanding of the nature of the proposed development, information requirements and the likely timescale for determination. This collaborative approach will ensure that all forestry issues are identified and mitigated at the earliest opportunity. The applicant should allow sufficient time in their project plan to accommodate such advice.

A52

Monday, 27 July 2020

Local Planner
Energy Consents Unit
5 Atlantic Quay
Glasgow
G2 8LU

Development Operations
The Bridge
Buchanan Gate Business Park
Cumbernauld Road
Stepps
Glasgow
G33 6FB

Development Operations
Freephone Number - REDACTE
E-Mail - DevelopmentOperations@scottishwater.co.uk
www.scottishwater.co.uk

Dear Sir/Madam

SITE: Clachaig Glen Wind Farm, , Near Muasdale, PA29 6XD
PLANNING REF: ECU00002103
OUR REF: DSCAS-0018558-MB4
PROPOSAL: Clachaig Glen Wind Farm

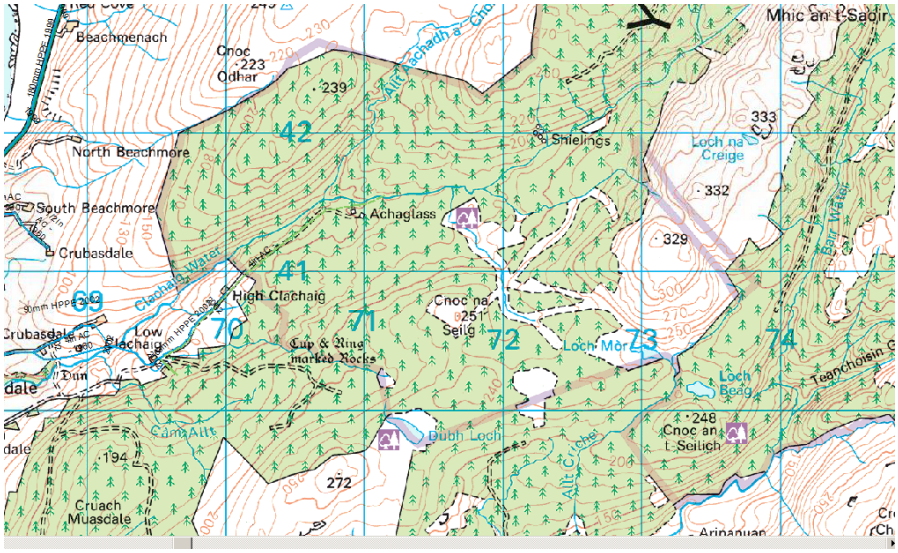
Please quote our reference in all future correspondence

Audit of Proposal

Scottish Water has no objection to this planning application; however, the applicant should be aware that this does not confirm that the proposed development can currently be serviced and would advise the following:

Asset Impact Assessment

According to our records, the development proposals impact on existing and abandoned Scottish Water assets.



The applicant must identify any potential conflicts with Scottish Water assets and contact our Asset Impact Team via our Customer Portal to apply for a diversion.

The applicant should be aware that any conflict with assets identified may be subject to restrictions on proximity of construction. Please note the disclaimer at the end of this response.

Drinking Water Protected Areas

The proposed windfarm lies within the disused Scottish Water drinking water source catchments of the Clachaig Water (Muasdale), Barr Water and Carradale Water. As these are no longer used for public water supply Scottish Water has no concerns in relation to drinking water supply or quality of these catchments.

The Carradale and Saddell boreholes are also located within the wider area. The Saddell boreholes are approximately 10km south-east of the site and will not be affected by the proposed development. The north-eastern tip of the development area encroaches into the uppermost part of the catchment of the Drochaid Burn which is a tributary of the Carradale Water. As there does not appear to be any development planned for this area, the risk to the Carradale Boreholes is considered to be low.

We welcome that reference has been made to the Scottish Water response to the previous consultation.

Surface Water

For reasons of sustainability and to protect our customers from potential future sewer flooding, Scottish Water will not accept any surface water connections into our combined sewer system.

There may be limited exceptional circumstances where we would allow such a connection for brownfield sites only, however this will require significant justification from the customer taking account of various factors including legal, physical, and technical challenges.

In order to avoid costs and delays where a surface water discharge to our combined sewer system is anticipated, the developer should contact Scottish Water at the earliest opportunity with strong evidence to support the intended drainage plan prior to making a connection request. We will assess this evidence in a robust manner and provide a decision that reflects the best option from environmental and customer perspectives.

General notes:

- Scottish Water asset plans can be obtained from our appointed asset plan providers:
    - Site Investigation Services (UK) Ltd
    - Tel: REDACTED
    - Email: sw@sisplan.co.uk
    - www.sisplan.co.uk
- Scottish Water's current minimum level of service for water pressure is 1.0 bar or 10m head at the customer's boundary internal outlet. Any property which cannot be adequately serviced from the available pressure may require private pumping arrangements to be installed, subject to compliance with Water Byelaws. If the developer wishes to enquire about Scottish Water's procedure for checking the water pressure in the area, then they should write to the Customer Connections department at the above address.
- If the connection to the public sewer and/or water main requires to be laid through land out-with public ownership, the developer must provide evidence of formal approval from the affected landowner(s) by way of a deed of servitude.
- Scottish Water may only vest new water or waste water infrastructure which is to be laid through land out with public ownership where a Deed of Servitude has been obtained in our favour by the developer.
- The developer should also be aware that Scottish Water requires land title to the area of land where a pumping station and/or SUDS proposed to vest in Scottish Water is constructed.
- Please find information on how to submit application to Scottish Water at our Customer Portal.

Next Steps:

- ### All Proposed Developments

  All proposed developments require to submit a Pre-Development Enquiry (PDE) Form to be submitted directly to Scottish Water via our Customer Portal prior to any formal Technical Application being submitted. This will allow us to fully appraise the proposals.

  Where it is confirmed through the PDE process that mitigation works are necessary to support a development, the cost of these works is to be met by the developer, which Scottish Water can contribute towards through Reasonable Cost Contribution regulations.

Non Domestic/Commercial Property:

Since the introduction of the Water Services (Scotland) Act 2005 in April 2008 the water industry in Scotland has opened to market competition for non-domestic customers. All Non-domestic Household customers now require a Licensed Provider to act on their behalf for new water and waste water connections. Further details can be obtained at www.scotlandontap.gov.uk

Trade Effluent Discharge from Non Dom Property:

- Certain discharges from non-domestic premises may constitute a trade effluent in terms of the Sewerage (Scotland) Act 1968. Trade effluent arises from activities including; manufacturing, production and engineering; vehicle, plant and equipment washing, waste and leachate management. It covers both large and small premises, including activities such as car washing and launderettes. Activities not covered include hotels, caravan sites or restaurants.
- If you are in any doubt as to whether the discharge from your premises is likely to be trade effluent, please contact us on REDACTED or email TEQ@scottishwater.co.uk using the subject “Is this Trade Effluent?". Discharges that are deemed to be trade effluent need to apply separately for permission to discharge to the sewerage system. The forms and application guidance notes can be found here.
- Trade effluent must never be discharged into surface water drainage systems as these are solely for draining rainfall run off.
- For food services establishments, Scottish Water recommends a suitably sized grease trap is fitted within the food preparation areas, so the development complies with Standard 3.7 a) of the Building Standards Technical Handbook and for best management and housekeeping practices to be followed which prevent food waste, fat oil and grease from being disposed into sinks and drains.
- The Waste (Scotland) Regulations which require all non-rural food businesses, producing more than 50kg of food waste per week, to segregate that waste for separate collection. The regulations also ban the use of food waste disposal units that dispose of food waste to the public sewer. Further information can be found at www.resourceefficientscotland.com

I trust the above is acceptable however if you require any further information regarding this matter please contact me on REDACTED or via the e-mail address below or at planningconsultations@scottishwater.co.uk.

Yours sincerely,

Pamela Strachan
Development Operations Analyst
developmentoperations@scottishwater.co.uk

Scottish Water Disclaimer:

"It is important to note that the information on any such plan provided on Scottish Water's infrastructure, is for indicative purposes only and its accuracy cannot be relied upon. When the exact location and the nature of the infrastructure on the plan is a material requirement then you should undertake an appropriate site investigation to confirm its actual position in the ground and to determine if it is suitable for its intended purpose. By using the plan you agree that Scottish Water will not be liable for any loss, damage or costs caused by relying upon it or from carrying out any such site investigation."

A57

ScotWays
Upholding public access

Econsents_Admin@gov.scot

Carolanne Brown
Energy Consents
Directorate for Energy and Climate Change
The Scottish Government

18/08/2020

Dear Ms Brown,

THE ELECTRICITY ACT 1989
THE ELECTRICITY WORKS (ENVIRONMENTAL IMPACT ASSESSMENT) (SCOTLAND) REGULATIONS 2017

SCOPING OPINION REQUEST – CLACHAIG GLEN WIND FARM PROPOSAL, ARGYLL & BUTE

Thank you for your email of 21 July 2020, consulting us on the above. We gratefully acknowledge the additional time granted for our response.

The National Catalogue of Rights of Way (CROW) does not show any rights of way directly affected by the site delineated on the applicant's Figure 1.2 *Site Boundary Plan*. However, as there is no definitive record of rights of way in Scotland, there may be routes that meet the criteria but have not been recorded because they have not yet come to our notice.

If the applicant is interested in rights of way and other recreational routes in the vicinity of the site in order to inform their Environmental Impact Assessment, they are welcome to contact the Society directly.

You will no doubt be aware there may now be general access rights over any property under the terms of the Land Reform (Scotland) Act 2003. If they have not already done so, it is anticipated that the applicant will also consult the Core Paths Plans, prepared by access authorities as part of their duties under this Act.

It should be noted that the *Kintyre Way,* a long distance route used by walkers, runners and cyclists, is affected by the proposed access route. This route is promoted by Scottish Natural Heritage as one of *Scotland's Great Trails*. We anticipate that the applicant will provide details of how public recreational access along this route will be maintained at all stages of the development should consent be granted. We strongly recommend that they consult with the access team at Argyll and Bute Council.

Although I understand that there is very little guidance regarding the siting of turbines in relation to established paths and rights of way, I would like to draw your attention to the following:

Extract from the Welsh Assembly Government's Technical Advice Note on Renewable Energy (TAN 8)

Proximity to Highways and Railways

2.25 It is advisable to set back all wind turbines a minimum distance, equivalent to the height of the blade tip, from the edge of any public highway (road or other public right of way) or railway line.

I hope the information provided is useful to you. Please do not hesitate to contact me if you need more detail or if you have any further queries.

Yours sincerely,

REDACTED

Lynda L Grant
Access Officer

A59

SEPA
Scottish Environment Protection Agency
Buidheann Dìon Àrainneachd na h-Alba

Our ref: PCS/172260
Your ref: ECU00002103

Caroline Brown
Scottish Government
4th Floor
5 Atlantic Quay
150 Broomielaw
Glasgow
G2 8LU

If telephoning ask for:
Julie Gerc

11 August 2020

By email only to: Econsents_Admin@gov.scot

Dear Madam

CLACHAIG GLEN WIND FARM PROPOSAL
Clachaig Glen Wind Farm, Argyll & Bute

Thank you for consulting SEPA on the scoping opinion for the above development proposal by your email received on 21 July 2020. We note this is a modified proposal of a wind farm for which we previously had no objections. It is understood that the main differences are increased blade heights, a reduction in turbine numbers from fourteen to twelve and the addition of battery storage.

Advice to the planning authority

We consider that the following key issues must be addressed in the Environmental Impact Assessment process. To **avoid delay and potential objection,** the information outlined below and in the attached appendix must be submitted in support of the application.

a) Map and assessment of all engineering activities in or impacting on the water environment including proposed buffers, details of any flood risk assessment and details of any related CAR applications.

b) Map and assessment of impacts upon Groundwater Dependent Terrestrial Ecosystems and buffers.

c) Map and assessment of impacts upon groundwater abstractions and buffers.

d) Peat depth survey and table detailing re-use proposals.

e) Map and table detailing forest removal.

f) Map and site layout of borrow pits.

g) Schedule of mitigation including pollution prevention measures.

h) Borrow Pit Site Management Plan of pollution prevention measures.

i) Map of proposed waste water drainage layout.

j) Map of proposed surface water drainage layout.

k) Map of proposed water abstractions including details of the proposed operating regime.

l) Decommissioning statement.

Further details on these information requirements and the form in which they must be submitted can be found in the attached appendix. We also provide site specific comments in the following section which can help the developer focus the scope of the assessment.

Regulatory advice for the applicant

1. Regulatory requirements

1.1 Authorisation is required under The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR) to carry out engineering works in or in the vicinity of inland surface waters (other than groundwater) or wetlands. Inland water means all standing or flowing water on the surface of the land (e.g. rivers, lochs, canals, reservoirs).

1.2 Management of surplus peat or soils may require an exemption under The Waste Management Licensing (Scotland) Regulations 2011. Proposed crushing or screening will require a permit under The Pollution Prevention and Control (Scotland) Regulations 2012. Consider if other environmental licences may be required for any installations or processes.

1.3 A Controlled Activities Regulations (CAR) construction site licence will be required for management of surface water run-off from a construction site, including access tracks, which:

- is more than 4 hectares,
- is in excess of 5km, or
- includes an area of more than 1 hectare or length of more than 500m on ground with a slope in excess of 25˚

See SEPA's Sector Specific Guidance: Construction Sites (WAT-SG-75) for details. Site design may be affected by pollution prevention requirements and hence we strongly encourage the applicant to engage in pre-CAR application discussions with a member of the regulatory services team in your local SEPA office.

1.4 Below these thresholds you will need to comply with CAR General Binding Rule 10 which requires, amongst other things, that all reasonable steps must be taken to ensure that the discharge does not result in pollution of the water environment. The detail of how this is achieved may be required through a planning condition.

1.5 Details of regulatory requirements and good practice advice for the applicant can be found on the Regulations section of our website. If you are unable to find the advice you need for a specific regulatory matter, please contact a member of the regulatory services team in your local SEPA office at:

AHSH@sepa.org.uk

If you have queries relating to this letter, please contact me by e-mail at planning.sw@sepa.org.uk

Yours faithfully

Julie Gerc
Senior Planning Officer
Planning Service

ECopy to:

Disclaimer
This advice is given without prejudice to any decision made on elements of the proposal regulated by us, as such a decision may take into account factors not considered at this time. We prefer all the technical information required for any SEPA consents to be submitted at the same time as the planning or similar application. However, we consider it to be at the applicant's commercial risk if any significant changes required during the regulatory stage necessitate a further planning application or similar application and/or neighbour notification or advertising. We have relied on the accuracy and completeness of the information supplied to us in providing the above advice and can take no responsibility for incorrect data or interpretation, or omissions, in such information. If we have not referred to a particular issue in our response, it should not be assumed that there is no impact associated with that issue. For planning applications if you did not specifically request advice on flood risk, then advice will not have been provided on this issue. Further information on our consultation arrangements generally can be found on our website planning pages.

Appendix 1: Detailed scoping requirements

This appendix sets out our scoping information requirements. There may be opportunities to scope out some of the issues below depending on the site. Evidence must be provided in the submission to support why an issue is not relevant for this site in order **to avoid delay and potential objection**.

If there is a delay between scoping and the submission of the application then please refer to our website for our latest information requirements as they are regularly updated; current best practice must be followed.

We would welcome the opportunity to comment on the draft submission. As we can process files of a maximum size of only 25MB the submission must be divided into appropriately named sections of less than 25MB each.

1. Site layout

1.1 All maps must be based on an adequate scale with which to assess the information. This could range from OS 1: 10,000 to a more detailed scale in more sensitive locations. Each of the maps below must detail all proposed upgraded, temporary and permanent site infrastructure. This includes all tracks, excavations, buildings, borrow pits, pipelines, cabling, site compounds, laydown areas, storage areas and any other built elements. Existing built infrastructure must be re-used or upgraded wherever possible. The layout should be designed to minimise the extent of new works on previously undisturbed ground. For example, a layout which makes use of lots of spurs or loops is unlikely to be acceptable. Cabling must be laid in ground already disturbed such as verges. A comparison of the environmental effects of alternative locations of infrastructure elements, such as tracks, may be required.

2. Engineering activities which may have adverse effects on the water environment

2.1 The site layout must be designed to avoid impacts upon the water environment. Where activities such as watercourse crossings, watercourse diversions or other engineering activities in or impacting on the water environment cannot be avoided then the submission must include justification of this and a map showing:

a) All proposed temporary or permanent infrastructure overlain with all lochs and watercourses.

b) A minimum buffer of 50m around each loch or watercourse. If this minimum buffer cannot be achieved each breach must be numbered on a plan with an associated photograph of the location, dimensions of the loch or watercourse and drawings of what is proposed in terms of engineering works.

c) Detailed layout of all proposed mitigation including all cut off drains, location, number and size of settlement ponds.

2.2 If water abstractions or dewatering are proposed, a table of volumes and timings of groundwater abstractions and related mitigation measures must be provided.

2.3 Further advice and our best practice guidance are available within the water engineering section of our website. Guidance on the design of water crossings can be found in our Construction of River Crossings Good Practice Guide.

2.4 Refer to Appendix 2 of our Standing Advice for advice on flood risk. Watercourse crossings must be designed to accommodate the 0.5% Annual Exceedance Probability (AEP) flows, or information provided to justify smaller structures. If it is thought that the development could result in an increased risk of flooding to a nearby receptor then a Flood Risk Assessment must be submitted in support of the planning application. Our Technical flood risk guidance for stakeholders outlines the information we require to be submitted as part of a Flood Risk Assessment. Please also refer to Controlled Activities Regulations (CAR) Flood Risk Standing Advice for Engineering, Discharge and Impoundment Activities.

3. Disturbance and re-use of excavated peat and other carbon rich soils

3.1 Scottish Planning Policy states (Paragraph 205) that "Where peat and other carbon rich soils are present, applicants must assess the likely effects of development on carbon dioxide (CO_2) emissions. Where peatland is drained or otherwise disturbed, there is liable to be a release of CO_2 to the atmosphere. Developments must aim to minimise this release."

3.2 The planning submission must a) demonstrate how the layout has been designed to minimise disturbance of peat and consequential release of CO_2 and b) outline the preventative/mitigation measures to avoid significant drying or oxidation of peat through, for example, the construction of access tracks, drainage channels, cable trenches, or the storage and re-use of excavated peat. There is often less environmental impact from localised temporary storage and reuse rather than movement to large central peat storage areas.

3.3 The submission must include:

a) A detailed map of peat depths (this must be to full depth and follow the survey requirement of the Scottish Government's Guidance on Developments on Peatland - Peatland Survey (2017)) with all the built elements (including peat storage areas) overlain to demonstrate how the development avoids areas of deep peat and other sensitive receptors such as Groundwater Dependent Terrestrial Ecosystems.

b) A table which details the quantities of acrotelmic, catotelmic and amorphous peat which will be excavated for each element and where it will be re-used during reinstatement. Details of the proposed widths and depths of peat to be re-used and how it will be kept wet permanently must be included.

3.4 To avoid delay and potential objection proposals must be in accordance with Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and Minimisation of Waste and our Developments on Peat and Off-Site uses of Waste Peat.

3.5 Dependent upon the volumes of peat likely to be encountered and the scale of the development, applicants must consider whether a full Peat Management Plan (as detailed in the above guidance) is required or whether the above information would be best submitted as part of the schedule of mitigation.

3.6 Please note we do not validate carbon balance assessments except where requested to by Scottish Government in exceptional circumstances. Our advice on the minimisation of peat disturbance and peatland restoration may need to be taken into account when you consider such assessments.

4. Disruption to Groundwater Dependent Terrestrial Ecosystems (GWDTE)

4.1 GWDTE are protected under the Water Framework Directive and therefore the layout and design of the development must avoid impact on such areas. The following information must be included in the submission:

a) A map demonstrating that all GWDTE are outwith a 100m radius of all excavations shallower than 1m and outwith 250m of all excavations deeper than 1m and proposed groundwater abstractions. If micro-siting is to be considered as a mitigation measure the distance of survey needs to be extended by the proposed maximum extent of micro-siting. The survey needs to extend beyond the site boundary where the distances require it.

b) If the minimum buffers above cannot be achieved, a detailed site specific qualitative and/or quantitative risk assessment will be required. We are likely to seek conditions securing appropriate mitigation for all GWDTE affected.

4.2 Please refer to Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems for further advice and the minimum information we require to be submitted.

5. Existing groundwater abstractions

5.1 Excavations and other construction works can disrupt groundwater flow and impact on existing groundwater abstractions. The submission must include:

a) A map demonstrating that all existing groundwater abstractions are outwith a 100m radius of all excavations shallower than 1m and outwith 250m of all excavations deeper than 1m and proposed groundwater abstractions. If micro-siting is to be considered as a mitigation measure the distance of survey needs to be extended by the proposed maximum extent of micro-siting. The survey needs to extend beyond the site boundary where the distances require it.

b) If the minimum buffers above cannot be achieved, a detailed site specific qualitative and/or quantitative risk assessment will be required. We are likely to seek conditions securing appropriate mitigation for all existing groundwater abstractions affected.

5.2 Please refer to Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems for further advice on the minimum information we require to be submitted.

6. Forest removal and forest waste

6.1 Key holing must be used wherever possible as large scale felling can result in large amounts of waste material and in a peak release of nutrients which can affect local water quality. The supporting information should refer to the current Forest Plan if one exists and measures should comply with the Plan where possible.

6.2 Clear felling may be acceptable only in cases where planting took place on deep peat and it is proposed through a Habitat Management Plan to reinstate peat-forming habitats. The submission must include:

a) A map demarcating the areas to be subject to different felling techniques.

b) Photography of general timber condition in each of these areas.

c) A table of approximate volumes of timber which will be removed from site and volumes, sizes of chips or brash and depths that will be re-used on site.

d) A plan showing how and where any timber residues will be re-used for ecological benefit within that area, supported by a Habitat Management Plan. Further guidance on this can be found in Use of Trees Cleared to Facilitate Development on Afforested Land – Joint Guidance from SEPA, SNH and FCS.

7. Borrow pits

7.1 Scottish Planning Policy states (Paragraph 243) that "Borrow pits should only be permitted if there are significant environmental or economic benefits compared to obtaining material from local quarries, they are time-limited; tied to a particular project and appropriate reclamation measures are in place." The submission must provide sufficient information to address this policy statement.

7.2 In accordance with Paragraphs 52 to 57 of Planning Advice Note 50 Controlling the Environmental Effects of Surface Mineral Workings (PAN 50) a Site Management Plan should be submitted in support of any application. The following information should also be submitted for each borrow pit:

a) A map showing the location, size, depths and dimensions.

b) A map showing any stocks of rock, overburden, soils and temporary and permanent infrastructure including tracks, buildings, oil storage, pipes and drainage, overlain with all lochs and watercourses to a distance of 250 metres. You need to demonstrate that a site specific proportionate buffer can be achieved. On this map, a site-specific buffer must be drawn around each loch or watercourse proportionate to the depth of excavations and at least 10m from access tracks. If this minimum buffer cannot be achieved each breach must be numbered on a plan with an associated photograph of the location, dimensions of the loch or watercourse, drawings of what is proposed in terms of engineering works.

c) You need to provide a justification for the proposed location of borrow pits and evidence of the suitability of the material to be excavated for the proposed use, including any risk of pollution caused by degradation of the rock.

d) A ground investigation report giving existing seasonally highest water table including sections showing the maximum area, depth and profile of working in relation to the water table.

e) A site map showing cut-off drains, silt management devices and settlement lagoons to manage surface water and dewatering discharge. Cut-off drains must be installed to maximise diversion of water from entering quarry works.

f) A site map showing proposed water abstractions with details of the volumes and timings of abstractions.

g) A site map showing the location of pollution prevention measures such as spill kits, oil interceptors, drainage associated with welfare facilities, recycling and bin storage and vehicle washing areas. The drawing notes should include a commitment to check these daily.

h) A site map showing where soils and overburden will be stored including details of the heights and dimensions of each store, how long the material will be stored for and how soils will be kept fit for restoration purposes. Where the development will result in the disturbance of peat or other carbon rich soils then the submission must also include a detailed map of peat depths (this must be to full depth and follow the survey requirement of the Scottish Government's Guidance on Developments on Peatland - Peatland Survey (2017)) with all the built elements and excavation areas overlain so it can clearly be seen how the development minimises disturbance of peat and the consequential release of CO_2.

i) Sections and plans detailing how restoration will be progressed including the phasing, profiles, depths and types of material to be used.

j) Details of how the rock will be processed in order to produce a grade of rock that will not cause siltation problems during its end use on tracks, trenches and other hardstanding.

8. Pollution prevention and environmental management

8.1 One of our key interests in relation to developments is pollution prevention measures during the periods of construction, operation, maintenance, demolition and restoration. A schedule of mitigation supported by the above site specific maps and plans must be submitted. These must include reference to best practice pollution prevention and construction techniques (for example, limiting the maximum area to be stripped of soils at any one time) and regulatory requirements. They should set out the daily responsibilities of ECOWs, how site inspections will be recorded and acted upon and proposals for a planning monitoring enforcement officer. Please refer to Guidance for Pollution Prevention (GPPs).

9. Life extension, repowering and decommissioning

9.1 Proposals for life extension, repowering and/or decommissioning must demonstrate accordance with SEPA Guidance on the life extension and decommissioning of onshore wind farms. Table 1 of the guidance provides a hierarchical framework of environmental impact based upon the principles of sustainable resource use, effective mitigation of environmental risk (including climate change) and optimisation of long term ecological restoration. The submission must demonstrate how the hierarchy of environmental impact has been applied, within the context of latest knowledge and best practice, including justification for not selecting lower impact options when life extension is not proposed.

9.2 The submission needs to demonstrate that there will be no discarding of materials that are likely to be classified as waste as any such proposals would be unacceptable under waste management licensing. Further guidance on this may be found in the document Is it waste - Understanding the definition of waste.

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Development Management and Strategic Road Safety
Roads Directorate

Buchanan House, 58 Port Dundas Road, Glasgow G4 0HF
Direct Line: REDACTED Fax: REDACTED
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TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

Carolanne Brown
Energy Consents Unit
The Scottish Government
5 Atlantic Quay
150 Broomielaw
Glasgow
G2 8LU

Econsents_Admin@gov.scot

Your ref:
ECU00002103

Our ref:
TS00538

Date:
30/07/2020

Dear Sirs,

THE ELECTRICITY ACT 1989

THE ELECTRICITY WORKS (ENVIRONMENTAL IMPACT ASSESSMENT) (SCOTLAND) REGULATIONS 2017

SCOPING OPINION REQUEST– CLACHAIG GLEN WIND FARM PROPOSAL, ARGYLL & BUTE

With reference to your recent correspondence on the above development, we acknowledge receipt of the Scoping Report (SR) prepared by Aecom in support of the above development.

This information has been passed to SYSTRA Limited for review in their capacity as Term Consultants to Transport Scotland – Roads Directorate. Based on the review undertaken, we would provide the following comments.

Proposed Development

The proposed development comprises 12 turbines with a maximum blade tip height of 180m, a maximum rotor diameter of 140m and a generating capacity in excess of 50MW, located approximately 20km north of Campbeltown and 1.8km north-east of Muasdale on the west coast of the Kintyre Peninsula. The nearest trunk road to the site is the A83(T), which lies approximately 1km to the west of the site.

We understand that in December 2019, a proposal for 14 turbines (13 with a blade tip height of up to 126.5m and one with a blade tip height of up to 115.5m was granted consent under section 47 of the Town and Country Planning (Scotland) Act 1997. The generating capacity of the consented development was 47.6MW. The application was accompanied by the 2016 EIA prepared by AECOM.

Assessment of Environmental Impacts

Paragraph 1.3 of the SR states that the Report recognises Regulation 5(4) under The Electricity Works (Environmental Impact Assessment) (Scotland) Amendment Regulations December 2017, which states: *'With a view to avoiding duplication of assessments, account is to be taken of the available results of other relevant assessments in preparing the EIA report.'* Reference is given to the Clachaig Glen Environmental Statement Volume 2a: Main Text in order to highlight where additional assessment should not be required / scope for assessment should be limited in order to prevent duplication.

A chapter is included in the SR that deals with Traffic, Transport and Access. This indicates that the forthcoming EIAR will be prepared in accordance with the Institute of Environmental Assessment (IEA) 'Guidelines for the Environmental Assessment of Road Traffic, 1993' (IEA, 1993). The assessment study area is identified as the following:

- A83(T) between Campbelltown and Lochgilphead;
- A83(T) east of Lochgilphead towards Tarbet;
- A816 between its junction with the A83(T) at Lochgilphead north towards Oban.

It is noted that the A816 is identified within the SR as being a trunk road. We can confirm that this is actually part of the local road network.

We note that the traffic assessment will conservatively assume that all construction material will be imported to the site as a worst-case scenario, with at least three potential offsite quarry locations being used. The locations of these are Oban, Furnace and Cairndow. Each of these locations lie north of the site and are reached via the A83(T).

Traffic counts have been obtained from the Department for Traffic (DfT) Annual Average Daily Traffic Flows and have been presented within Table 14.1 of the SR. The SR indicates that the EIAR will provide an assessment of the construction stage including the preferred route options for the movement of loads and an estimate of vehicle trip generation from the site.

The SR also indicates that environmental impacts such as driver delay, pedestrian amenity, severance, safety etc will be considered and assessed where appropriate, using the Institute of Environmental Management and Assessment Guidelines. These specify that road links should be taken forward for assessment if:

- Traffic flows will increase by more than 30%, or
- The number of HGVs will increase by more than 30%, or
- Traffic flows will increase by 10% or more in sensitive areas.

This approach is considered acceptable and we are content that no further assessment is required if the above thresholds are not exceeded.

Abnormal Loads Assessment

The preferred route for delivery of turbine components is from Campbeltown harbour along the A83(T) northwards for approximately 28km to Killean where an overrun area would be provided on existing 3rd party land to the west of the A83(T) to assist with the right turn manoeuvre required.

The SR states that an access assessment of the abnormal load route from harbour to site has been undertaken by AECOM in 2020. This includes a swept path analysis of the route from Campbeltown to Killean using a 67.2m blade as part of the assessment of the route for the Eredine project, which is located further north in Argyll.

The SR goes on to state "*Given the increased rotor diameter (140m max) proposed for Clachaig Glen as part of the current application, SPA showing a vehicle carrying a Vestas V136 for the remainder of the route through Killean Forrest would be included as a Technical Appendix to the EIA Report.*"

It should be noted that while it is accepted that previous assessments have been carried out, Transport Scotland will require to be satisfied that the increased size of turbines proposed can negotiate the selected trunk road route and that their transportation will not have any detrimental effect on structures within the trunk road route path. A full Abnormal Loads Assessment report should be provided with the EIAR that identifies key pinch points on the trunk road network. Swept path analysis should be undertaken and details provided with regard to any required changes to street furniture or structures along the route.

The SR indicates that a Construction Traffic Management Plan (CTMP) will be developed in consultation with ABC, Transport Scotland (as necessary), Police Scotland and other stakeholders following award of consent. Transport Scotland is satisfied with this approach.

I trust that the above is satisfactory and should you wish to discuss any issues raised in greater detail, please do not hesitate to contact Alan DeVenny at SYSTRA's Glasgow Office on REDACTE RED .

Yours faithfully
Redacted

Gerard McPhillips

Transport Scotland
Roads Directorate

cc Alan DeVenny – SYSTRA Ltd.

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WEST KINTYRE COMMUNITY COUNCIL

Response to Scoping opinion request

Clachaig Glen Wind Farm Proposal, Argyll, and Bute

ECU Ref: ECU00002103

With regards to the scoping opinion request received by the West Kintyre Community Council concerning ECU application reference number **ECU00002103** on behalf of the residents of West Kintyre Community Council (WKCC) we wish to respond as follows:

In January 2019 The West Kintyre Community Council were party to the conjoined hearing called to hear an appeal hearing concerning the original Clachaig Glen application ref: PPA-130-3 and that of the Killean Wind Farm public hearing ref: WIN-130-3.

The WKCC objected to both applications on the grounds of landscape and cumulative visual impact, impacts on tourism, increased flood risk and transportation impacts.

Following this conjoined hearing the Scottish Ministers approved the application for Clachaig Glen but refused the Killean application. The application submitted and approved for Clachaig Glen was for 14 turbines of 125meter to tip height.

When the Scottish Ministers refused the application for the Killean development proposed for development next door to the Clachaig Glen site and using the same access route the reasons given by the reporter for refusal of the Killean application state:

"*There is no doubt that the proposal would make a positive contribution to renewable energy production in Scotland and would assist in the reduction of carbon emissions*

In our judgement, the scale of the harmful visual effects of the proposal would outweigh the benefits of the project. We consider that the proposal is contrary to the local development plan policy LDP6 and it does not benefit from the Scottish Planning Policy presumption in favour of sustainable development.

The visual impacts are unacceptable due to the siting and size of turbines. Having taken into account the advice of Scottish Natural Heritage, we agree with the council and community council's that consent should be refused"

Given the Killean application was for turbines of a tip height of 149.9 meters was considered by the reporter to be unacceptable due to size we believe this application by RWE to reduce the number of turbines to that of 12 but increase the size of turbines to that of tip heights of up to 180 meters is both unacceptable and contrary to the local development plan policy LDP6 plus the local landscape wind energy capacity study 2017 (LWECS) which states that the Kintyre Peninsula has no scope for new applications above 130 meters to tip.

It is our opinion that if this application progressed to a full planning application it should be refused on the grounds that there would be significant adverse effects due to its scale, high visibility and prominence in key views to and from West Kintyre including recreation areas, tourist routes both on and off shore plus the designated local area of panoramic quality on the coast of the peninsula.

Tourism is a vital part of the local economy of this rural community. One of the Scottish Government's key ambitions is to grow tourism within Scotland we therefore believe the developer RWE should be instructed to follow both the Scottish Government and Visit Scotland's advice on windfarms and carry out an <u>independent</u> tourism impact statement geographically sensitive to the area(in this case Kintyre) including consideration of any concerns raised relating to the impact and any perceived proliferation of developments may have on local tourism and therefore the local economy. We do not accept that developers

should be allowed to just use old out of date studies on the impact of wind farms on tourism that are not relevant to Kintyre. Considering the number of operational, under construction and consented developments already present on the peninsula it really is time a meaningful tourism impact survey was undertaken for this specific area which has both national long distance cycle routes and the Kintyre Way long distance walk traversing the whole of the Kintyre peninsula.

We trust these observations will be considered.

Margaret Pratt

Convener West Kintyre Community Council

July 31st, 2020

RWE

Clachaig Glen Wind Farm

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Appendix 5.3: Responses to Section 36 Gatecheck

Appendix 5.3 Responses to Section 36 Gatecheck

1. Introduction

1.1.1 This Appendix provides the responses received from the Gatecheck process conducted as part of the Section 36 Application for the Proposed Development to the Scottish Government Energy Consent Unit.

2. Argyll and Bute Council (26 August 2021)

2.1.1 I would confirm that I have reviewed the Gatecheck Report and I am content that all matters raised by Argyll & Bute Council in our Scoping response have been addressed and will be covered in the EIAR.

3. Highlands and Islands Airport (16 August 2021)

3.1.1 With reference to the above proposed development, we have reviewed the Gatecheck report and confirm the issues raised in the scoping consultation response have been adequately addressed by the developer.

3.1.2 Therefore, Highlands and Islands Airports Limited has no objections to the proposal.

4. Historic Environment Scotland (29 July 2021)

4.1.1 We have reviewed the submitted Gatecheck Report and can confirm that the applicant has undertaken an appropriate consultation with us and is proposing a plan of action that is in line with our previous comments. We understand that the applicant is currently refining a setting assessment and carrying out a walk over survey of the development site and its vicinity. We will be happy to offer additional comments on this assessment once it is finalised.

5. NatureScot (30 July 2021)

5.1.1 Thank you for consulting NatureScot on the submitted Gatecheck Report for the proposed Clachaig Glen Wind Farm. We have provided advice at each stage of this development this far, and these responses are still relevant.

5.1.2 Having reviewed the Gatecheck report, we are content that the Applicant appears to have taken on board the advice we have provided with regards to the scope of the EIA. However, at this stage there is no opportunity to comment on the quality of the work undertaken. Therefore, please note that our

advice is given without prejudice to a full and detailed consideration of the impacts of the proposal if submitted for formal consultation as part of the EIA process.

5.1.3 We note the update provided by the Applicant on the aviation lighting requirement as detailed in paragraphs 4.3.7 to 4.3.16 of Gatecheck Report. As it will not be feasible to use the Electronic Conspicuity Aircraft Detection Light System at this time, the aviation lighting assessment will therefore need to represent the worst case scenario as per our guidance.

5.1.4 Prior to the publishing of the EIA Report, we wish to draw the Applicant's attention to our 'general pre-application / scoping advice to developers of onshore wind farms' guidance, in particular to the preferred formatting of the report and associated figures and appendices. This document is regularly updated over to time to reflect any changes to available information and our guidance, so users should ensure they refer to the most up to date version before use.

6. Scottish Environment Protection Agency (09 August 2021)

6.1.1 Thanks for consulting us on the Gatecheck Report (dated July 2021) for the proposed Clachaig Glen Wind Farm on 27 July 2021. We can confirm we are generally content with the applicant's approach to addressing our scoping comments (dated 11 August 2020) as described in Table 4-2 of the report. However, we expect the EIAR to include an assessment of the impacts upon groundwater abstractions (e.g. private water supplies) in line with our guidance (https://www.sepa.org.uk/media/144266/lups-gu31-guidance-on-assessing-the-impacts-of-development-proposals-on-groundwater-abstractions-and-groundwater-dependent-terrestrial-ecosystems.pdf) rather than being covered post consent within a Construction Environmental Management Plan (CEMP).

6.1.2 As no information has been provided with the Gatecheck Report regarding underpinning site surveys, site constraints and intended buffers zones from sensitive receptors we cannot offer any comments on the appropriateness of the site design at this stage. We'd be happy to be reconsulted pre application on this if this information is available. Otherwise, we will consider our position when formally consulted on the application and associated EIAR.

7. Scottish Forestry (17 August 2021)

7.1.1 Thank you for sending on the Gate Check Report. I am pleased to see that there will be a chapter on Forestry and that the developer has been working with FLS to integrate the forest design and development.

7.1.2 Scottish Forestry (SF) has considered the Report and advise that both the UK Forestry Standard - 4th Edition – 2017 (UKFS) and Scottish Governments Control of Woodland Policy 2009 (CoWRP) apply to the proposal.

7.1.3 There appears to be no specific mention of CoWRP and we assume that this along with any compensatory planting requirements will be fully covered in the Forestry Chapter or appendices.

8. Transport Scotland (16 August 2021)

8.1.1 Table 4-2 of the Gate Check report acknowledges Transport Scotland's comments regarding the need for an Abnormal Loads Assessment, and states "these assessments have been conducted for the design of the Proposed Development and will be reported in Chapter 14 of the EIAR." No reference is made to our comments on the impact assessment, however, we note that in response to comments made by Argyll and Bute Council, the Gate Check report indicates that Chapter 14 of the EIAR (Traffic and Transport) will focus on the assessment of construction impacts.

8.1.2 Transport Scotland is satisfied that the forthcoming EIAR will adequately address the issues as raised within our Scoping Response, and we have no further comment to make at this time.

RWE

Clachaig Glen Wind Farm

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RWE

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Appendix 7.1: Landscape and Visual Methodology

Appendix 7.1 Landscape and Visual Methodology

1. Introduction

1.1.1 This Appendix provides details of the approach and methodology used for the Landscape and Visual Impact Assessment (LVIA) for the Proposed Development set out in Chapter 7: Landscape and Visual (EIAR Volume 2a).

1.1.2 Landscape and visual effects are interrelated to one another but are assessed separately in line with best practice. Landscape character effects relate to changes to both the physical elements of the landscape and the perceptual aspects and qualities which contribute to its distinctive character. Visual effects relate to changes to views experienced by people through the addition and/or removal of elements.

1.1.3 The LVIA focuses on likely significant effects that may arise as a result of the Proposed Development, both on its own and also in combination with other existing and proposed wind farms.

2. Guidance

2.1.1 The methodology has been developed by Chartered Landscape Architects and has been informed by the principles set out in best practice guidance coupled with professional experience of undertaking LVIAs for wind farms. The principal guidance documents which have informed the methodology include.

- Guidelines for Landscape and Visual Impact Assessment, Third Edition, Landscape Institute, and Institute of Environmental Management & Assessment (2013) ('GLVIA'),
- Assessing landscape value outside national designations, Technical Guidance Note 02/21, Landscape Institute (2021),
- Assessing the Cumulative Impact of Onshore Wind Energy Developments, Scottish Natural Heritage (2012),
- Visual Representation of Wind Farms, Version 2.2, Scottish Natural Heritage (2017),
- Siting and Designing Wind Farms in the Landscape, Guidance, Version 3a (2017), Scottish Natural Heritage,
- Spatial Planning for Onshore Wind Turbines – natural heritage considerations, Scottish Natural Heritage (2015),
- Policy Statement No 02/02: Strategic Locational Guidance for Onshore Windfarms in Respect of the National Heritage, Scottish Natural Heritage (updated 2009),
- Assessing impacts on Wild Land Areas – technical guidance, Scottish Natural Heritage (2020): [Available online] https://www.nature.scot/assessing-impacts-wild-land-areas-technical-guidance, and

- General pre-application and scoping advice for onshore wind farms, Scottish Natural Heritage (2020)

2.1.2 The following draft guidance has also been referred to in the preparation of the LVIA:

- Guidance for Assessing the Effects on Special Landscape Qualities, NatureScot (Working Draft 11, 2018).

3. Technical Scope

3.1.1 The LVIA aims to identify the likely significant landscape and visual effects of the Proposed Development upon the Development Site and surrounding area.

3.1.2 The assessment forms part of an iterative process where, as potentially significant effects are identified, these inform the siting and design of the Proposed Development alongside consideration of other constraints. This process and the considerations which have informed it are described within the Design Statement. Chapter 3 of the EIAR: Project Description, describes the final configuration of the Proposed Development which forms the basis of the assessment of effects.

3.1.3 When considering the potential changes that future development may have on the landscape and visual resource, it is necessary to identify those key elements of the landscape which make it distinctive. These elements mainly comprise landform, settlement pattern, land use and built environment, circulation and access, vegetation and views.

3.1.4 Landscape effects arise from changes to the physical components of the landscape, its character and how this is experienced.

3.1.5 In relation to 'visual effects', visual amenity can be described as the appreciation or pleasantness of the views people enjoy of their surroundings and as such includes a degree of subjectivity. The visual assessment determines the degree of anticipated change to views and visual amenity that would occur as a result of the Proposed Development, based on professional judgement. The visual assessment considers both fixed views from static locations and sequential views experienced from key transport and recreational routes.

3.1.6 Landscape and visual effects can be positive (beneficial) or negative (adverse). The landscape and visual resource of an area can be affected both directly and indirectly. GLVIA (page36, paragraph 3.22) requires consideration of landscape and visual effects as follows:

"*…thought must be given to whether the likely significant landscape and visual effects can result directly from the development itself (direct effects) or from consequential change resulting from the development (indirect and secondary effects); are additional effects caused by the proposed development when considered in conjunction with other proposed developments of the same or different types (cumulative effects); are likely to be short term or to carry on over a longer period of time; are likely to be permanent or temporary, in which case their duration is important; are judged to be positive (beneficial) or negative (adverse) in their consequences for landscape or for views and visual amenity".*

3.1.7 The Proposed Development includes medium intensity aviation obstruction lighting on the nacelle of eight of the turbines, in line with Civil Aviation Authority (CAA) requirements. Aviation lighting has the potential to contribute to landscape and visual effects and as such the assessment findings include consideration of potential change experienced during the daytime and at night. As the aviation lighting is a fixed part of the Proposed Development daytime and night-time change is reported together in one combined judgement. The influence of aviation lighting is primarily considered in relation to visual receptors and visual effects but is also considered in the context of the 'host' landscape character unit and nationally designated landscapes. Judgements related to the influence of visible lighting at night are informed by technical lighting information coupled with qualitative assessments based on an understanding of the night-time baseline. Appendix 7.2 (EIAR Volume 3) provides background information related to the requirements for aviation lighting and an overview of the approach taken for the Proposed Development. Detailed technical information on aviation lighting is provided in Appendix 16.1 (EIAR Volume 3).

3.1.8 The LVIA also considers potential cumulative effects of the Proposed Development with other developments in the vicinity. Cumulative effects arise from the additional changes brought about by one development in conjunction with those of one or more similar developments. Other wind farm developments that are operational, are under construction, have been granted planning consent or are subject to a planning application have been identified for inclusion in the cumulative assessment and have been agreed in consultation with Argyll and Bute Council (ABC) and NatureScot. The cumulative assessment considers potential effects on landscape receptors, static viewpoint locations and potential sequential effects on key routes, taking account of the potential additional change in daytime and night-time conditions.

4. Temporal Scope

4.1.1 Levels of landscape and visual change can differ from one stage of the development to the next and therefore it is necessary to consider potential effects at each phase. The type and duration of the landscape and visual effects considered in this assessment fall within three main phases, as described below.

4.2 Construction Phase

4.2.1 Construction stage effects relate to changes that are temporary in nature and of a short duration (12 months to a maximum of 18 months), and include the following:

- Potential temporary physical change arising from construction of the Proposed Development on the landscape resource within the Development Site,
- Potential temporary change to landscape character or visual amenity within the wider study area as a result of visibility of construction activities or the Proposed Development during construction, and
- Change resulting from temporary site infrastructure, such as small temporary quarry operations; site traffic; laying of underground cabling; and construction compounds.

4.2.2 For the purposes of this assessment, proposed permanent structures, including wind turbines, are not included within the construction stage assessment as potential impacts of the partially constructed structures are considered to be similar to, but less than, the completed structures which are assessed as part of the operational phase, as described below.

4.3 Operation Phase

4.3.1 Operation stage effects relate to longer term changes anticipated to occur during the operational lifespan of the Proposed Development, which is proposed to be 35 years. Operational stage landscape and visual effects may occur as a result of the following:

- Potential change to landscape character and designations (both physical and perceptual aspects) and to views and visual amenity resulting from the removal of existing features and introduction of new structures and elements including:
  - 12 wind turbines, seven of which would have a maximum height to blade tip of up to 185m, a maximum nacelle (hub) height of up to 112m, and maximum rotor diameter of up to 155m, and the remaining five would have a maximum height to blade tip of up to 200m, a maximum hub height of up to 132m, and maximum rotor diameter of up to 155m,
  - a permanent anemometer mast (lattice structure) up to 110m in height,
  - a Control Building, Substation Compound and Battery Storage (Control Building up to 5.5m maximum height and Battery Storage comprising 27 containers not exceeding 2.6m height), and
  - 8.9km length of new access track and 2.1km upgraded existing track within the main Development Site (alongside 6km upgraded access track from A83 to main Development Site),
- Potential cumulative change resulting from the Proposed Development in combination with other existing and consented wind farms and wind farms subject to undetermined applications, upon the landscape and visual resource of the study area.

4.3.2 The LVIA is based on the maximum blade tip and hub heights as this is considered to represent the 'worst case' scenario. In reality the hub heights may be lower to facilitate a larger rotor diameter/blade length, within the stated maximum parameters; Aviation obstruction lighting would be provided on eight of the turbines, as described in Appendix 16.1: Aviation Lighting and Mitigation Report (EIAR Volume 3). Infra-red aviation lighting would also be required on eight turbines but as this type of lighting is not visible to the naked eye it is not included within the LVIA.

4.4 Decommissioning

4.4.1 Effects arising from the process and activities associated with decommissioning have been considered but are not assessed in detail as they are of a similar nature to construction issues (in reverse), but would be less intrusive, of a smaller scale and shorter duration. Decommissioning effects would be temporary and of a short duration (anticipated period of 12 months).

5. Study Area

5.1.1 The study area for the LVIA is defined as 45 km from the outermost turbines of the Proposed Development as recommended by NatureScot Guidance.[1].

5.1.2 Initial desk and field-based survey and analysis, including the use of Zone of Theoretical Visibility (ZTV) diagrams and wirelines, indicated that significant landscape and visual effects are unlikely to occur beyond 10 to 15 km of the Proposed Development. Taking a precautionary approach, a detailed study area of 20 km from the outermost turbines has been identified (See Figure 7.1, EIAR Volume 2c), allowing a targeted proportionate approach focused on potential significant effects. The extent of the study area was agreed in consultation with NatureScot and ABC, with a few additional viewpoints requested from key locations beyond this area.

5.1.3 An initial search area of 60 km from the Proposed Development was utilised for the cumulative assessment. All identified large scale wind farms within the search area, along with smaller scale and single turbine developments within 20 km where mapped. A short list of wind developments to be included within the cumulative assessments, focused on those with the potential to contribute to significant effects, was then identified through initial appraisal and consultation with ABC and NatureScot.

6. Assessment Process

6.1.1 The landscape and visual assessments have been undertaken in accordance with the approach and principles set out in GLVIA and with reference to the guidance listed in Section 2, above.

6.1.2 The assessments have been undertaken based on the following main steps:

- Establishment of the baseline,
- Appreciation of the Proposed Development, and
- Assessment of effects.

6.2 Establishment of the Baseline

6.2.1 A baseline study has been undertaken through a combination of desk-based research and site appraisal in order to establish the existing conditions of the landscape and visual resources of the study area. Extensive site survey of the landscape of Kintyre and the wider study area was undertaken by the authors of this report in different seasons and conditions for the 2016 EIA, and subsequently the 2019 Public Inquiry. Further detailed and targeted field survey work, including during both the daytime and at night has been undertaken between September 2020 and June 2021.

6.2.2 The landscape baseline study identifies landscape designations and distinct landscape character units within the study area and describes their key characteristics and special qualities. The visual baseline aids in the identification of potential visual receptor locations and provides a description of

[1] SNH (2017) Visual Representation of Wind Farms, Version 2.2, February 2017

the nature of the existing views. A description of both the daytime and night-time baseline is provided for relevant receptors.

6.3 Appreciation of the Proposed Development

6.3.1 In order to be able to accurately assess the full extent of likely effects on landscape character and visual amenity it is essential to develop a thorough and detailed knowledge of the Proposed Development. This includes a comprehensive understanding of its location, nature and scale and is achieved through a review of drawings, computer modelling and on-site appraisal. The LVIA includes consideration of all elements of the Proposed Development as detailed in Chapter 3: Project Description (EIAR Volume 2a).

6.4 Assessment of Effects

6.4.1 The landscape and visual assessments seek to identify, predict, and evaluate the significance of potential effects to landscape characteristics and established views. The assessments are based on an evaluation of the sensitivity to change and the magnitude of effect for each landscape or visual receptor. For clarity and in accordance with good practice, the assessment of potential effects on landscape character and visual amenity, although closely related, are undertaken separately.

6.4.2 The prominence of the turbines in the landscape or view will vary according to the prevailing weather conditions. The assessments have been carried out by assuming the 'worst case' scenario, namely on a clear, bright day in winter, when neither foreground deciduous foliage nor haze can interfere with the clarity of the view obtained. Determining the potential worst case in respect of the aviation lighting is more complex as the lighting operates at different intensities depending on the atmospheric conditions. In clear conditions (visibility greater than 5 km) when the lighting is theoretically more likely to be visible it would be operating on a lower intensity mode, 10% of that of the peak intensity. Conversely when the atmospheric conditions result in visibility of less than 5 km the lighting would be operating at the peak intensity mode but would often be at least partially obscured by cloud. The assessments are therefore taken by considering both the theoretical, but unlikely, worst case of the lights operating at full intensity during clear visibility, and the more realistic scenario that when lights are visible they would be operating at the lower intensity mode or would be at least partially obscured by cloud. Further details on the influence of weather and angle of view in relation to aviation lighting is provided in Appendix 16.1: Aviation Lighting and Mitigation Report (EIAR Volume 3). The vertical angle of view and directionality of the aviation lighting is also taken into account in the assessment as it can influence the apparent intensity of the lighting.

6.4.3 GLVIA places a strong emphasis on the importance of professional judgement in identifying and defining the significance of landscape and visual effects. This LVIA has been undertaken by Chartered Landscape Architects (see Appendix 1.1, EIAR Volume 3) and professional judgement has been used in combination with structured methods and criteria to evaluate value, susceptibility, sensitivity, magnitude, and significance of effect.

7. Method of Assessment: Landscape Character

7.1.1 Physical and cultural elements such as landform, hydrology, vegetation, land cover, land use pattern, and cultural and historic features combine to create a common 'sense of place' and identity that is experienced as landscape character. Definable units (character areas and character zones) can be used to categorise the landscape and the level of detail and size of unit can be varied to reflect the scale of definition required. It can be applied at national, regional and local levels.

7.1.2 The landscape resources within the study area that could be affected by the Proposed Development include:

- Physical resources such as open space, landform, trees, woodland, watercourses etc.,
- Landscape character,
- Designated or valued landscapes, and
- Cultural heritage interests that contribute to landscape character.

7.2 Landscape Sensitivity to Change

7.2.1 The sensitivity of a landscape to change varies according to the nature of the existing resource and the nature of the proposed changes as a result of the Proposed Development. The sensitivity of the landscape receptor is a combination of the value of the landscape (undertaken as part of the baseline study) and the susceptibility to change of the receptor to the specific type of development being assessed.

7.2.2 Landscape value is frequently addressed by reference to international, national, regional, and local designations, determined by statutory bodies and planning agencies. Absence of such a designation does not necessarily imply a lack of quality or value. Factors such as accessibility and local scarcity can render areas of nationally unremarkable quality, valuable as a local resource. The evaluation of landscape value is informed by the Landscape Institute TGN 02/21 and GLVIA page84, paragraph 5.28 / Box 5.1, and has been undertaken considering the following factors and classified as high, medium, or low with evidence provided as to the basis of the evaluation:

- Natural heritage - landscape with clear evidence of ecological, geological, geomorphological, or physiographic interest which contribute positively to the landscape,
- Cultural heritage - landscape with clear evidence of archaeological, historical or cultural interest which contribute positively to the landscape,
- Landscape quality / condition - the measure of the physical state of the landscape including the intactness of the landscape and the condition of individual elements,
- Scenic quality - the level of visual and sensory appeal of the landscape,
- Perceptual aspects - the extent that the landscape receptor is recognised for its perceptual qualities (e.g. scenic, wildness or tranquillity),
- Functional - landscape which performs a clearly identifiable and valuable function, particularly in the healthy functioning of the landscape

- Rarity - the presence of unusual elements or features,
- Representativeness / Distinctiveness- the presence of particularly characteristic features,
- Recreation - the extent that recreational activities contribute to the landscape receptor, and
- Association - extent that cultural or historical associations contribute to the landscape receptor.

7.2.3 The three-point scale outlined in Table 1 has been used to help inform the judgements of landscape value for each receptor.

Table 1 Landscape Value Criteria

Class	Criteria Description
High	Nationally designated or iconic, unspoiled landscape with few, if any, degrading elements.
Medium	Regionally or locally designated landscape or an undesignated landscape with locally important landmark features and some detracting elements.
Low	Undesignated landscape with few, if any, distinct features or several degrading elements.

7.2.4 GLVIA explains the susceptibility to change, as “the ability of the landscape receptor (whether it be the overall character or quality / condition of a particular landscape type or area, or an individual element and / or feature, or a particular aesthetic and perceptual aspect) to accommodate the Proposed Development without undue consequences for the maintenance of the baseline situation and/or the achievement of landscape planning policies and strategies” (page 88, paragraph 5.40). The more susceptible the receptor is to the type of change proposed, the greater is its sensitivity.

7.2.5 With reference to wind farms, it is generally accepted that large scale, simple landscapes are less susceptible to change than smaller scale, more intimate or complex landscapes. The three-point scale outlined in Table 2 has been used to help inform the judgments of landscape susceptibility.

Table 2 Landscape Susceptibility Criteria

Class	Criteria Description
High	Small scale, intimate or complex landscape with no existing context of similar development, considered to be intolerant of even minor change.
Medium	Medium scale, more open or less complex landscape with some context of similar development, considered tolerant to some degree of change.
Low	Large scale, simple landscape with or without existing context of similar development, considered tolerant of a large degree of change.

7.2.6 The sensitivity of the landscape to change is determined by employing professional judgement to combine and analyse the identified value and susceptibility and is defined with reference to the criteria outlined in Table 3.

Table 3 Landscape Sensitivity Criteria

Class	Criteria Description
High	Landscape characteristics or features with no ability to absorb change without fundamentally altering their present character, e.g. within a nationally designated landscape or an outstanding example in the area of well cared for landscape or set of features.
Medium	Landscape characteristics or features with some ability to absorb change without fundamentally altering their present character, e.g. within a locally designated landscape or a landscape with characteristics or elements of local importance.
Low	Landscape characteristics or features which are tolerant of a large degree of change without determent to their present character, e.g. within an undesignated landscape with limited local value or an example of a degraded landscape or set of features.

7.3 Magnitude of Landscape Effect

7.3.1 Magnitude of landscape change refers to the extent to which the Proposed Development would alter the existing characteristics of the landscape. It is an expression of the size or scale of change to the landscape, the geographical extent of the area influenced and its duration and reversibility. The variables involved are described below:

- Whether the effect changes the key characteristics of the landscape which are integral to its distinctive character,
- The extent of existing landscape elements that will be lost, the proportion of the total extent that this represents and the contribution of that element to the character of the landscape,
- The extent to which aesthetic or perceptual aspects of the landscape are altered either by removal of existing components of the landscape or by addition of new ones,
- The geographic area over which the landscape effects will be felt (within the Development Site, the immediate setting of the Development Site, at the scale of the landscape type or character area, or on a larger scale influencing several landscape types or character areas), and,
- The duration of the effect (short term, medium term or long term) and the reversibility of the effect (whether it is permanent, temporary or partially reversible).

7.3.2 An overall assessment of the magnitude of landscape change resulting from the Proposed Development on the landscape receptor is made combining the above judgements using evidence and professional judgement. The levels of magnitude of change are described as being high, medium, low, very low and are defined in Table 4.

Table 4 Landscape Magnitude Criteria

Class	Criteria Description
High	Introduction of incongruous development which would result in noticeable change over an extensive area, affecting many key characteristics and the experience of the landscape.
Medium	Introduction of uncharacteristic development which would result in noticeable change over a large area, or more intensive change over a limited area, affecting some key characteristics and the experience of the landscape.
Low	Introduction of development that is not uncharacteristic which would result in a small change over a limited area affecting few characteristics.
Very Low	Little perceptible change to the landscape characteristics.

8. Method of Assessment: Visual Amenity

8.1.1 For a visual effect to occur, there is the need for a viewer (receptor). Receptors include residential properties, workplaces, recreational facilities, road and ferry users, pedestrians and other outdoor sites used by the public which would be likely to experience a change in existing views as a result of the Proposed Development. The sensitivity of visual receptors varies depending on the nature of the existing view and the occupation or activity of the receptor at a particular location.

8.2 Visual Sensitivity to Change

8.2.1 Visual sensitivity to change is defined through appraisal of the viewing expectation, or value, of the existing view as identified in the baseline, and its susceptibility to change.

8.2.2 The value of the view is an appraisal of the value attached to views and is often informed by the appearance on Ordnance Survey or tourist maps and in guidebooks, literature or art or identified in policy. Value can also be indicated by the provision of parking or services, signage, and interpretation. The nature and composition of the view and its scenic quality is also an indicator.

8.2.3 It is important to note that the absence of view recognition does not preclude local value, as a view may be important as a resource in the local or immediate environment due to its relative rarity or local importance.

8.2.4 The three-point scale outlined in Table 5 has been used to help inform the judgements of value of the view for each receptor location.

Table 5 Value of the View Criteria

Class	Criteria Description
High	Nationally recognised or iconic view of the Scottish landscape, with no detracting elements.
Medium	Regionally or locally recognised view, or unrecognised but pleasing and well composed view, with few detracting elements.
Low	Typical or poorly composed view, often with numerous detracting elements.

8.2.5 The susceptibility of visual receptors is a function of the occupation or activity of people experiencing the view and the extent to which their attention or interest is focussed on the view and the visual amenity they experience at a particular location. For example, residents in their home, walkers whose interest may tend to be focused on the landscape or a particular view, or visitors at an attraction where views are an important part of the experience, may indicate a higher level of susceptibility. Whereas receptors occupied in outdoor sport where views are not important or at their place of work could be considered less susceptible to change. Visual susceptibility has been determined with reference to the three-point scale set out in Table 6.

Table 6 Visual Susceptibility Criteria

Class	Criteria Description
High	Locations where the view is of primary importance and includes no existing context of similar development, and receptors are likely to notice even minor change.
Medium	Locations where the view is important but not the primary focus and may include some existing context of similar development and is tolerant of some change.
Low	Locations where the view is incidental or unimportant and may or may not include context of existing development and is tolerant of a high degree of change.

8.2.6 Visual sensitivity to change is determined by employing professional judgement to combine and analyse the identified value and susceptibility and is defined with reference to the criteria outlined in Table 7.

Table 7 Visual Sensitivity Criteria

Class	Criteria Description
High	Highly valued impressive or well composed view with no detracting features, where receptors would notice even minor change, e.g. residents in dwellings or users of outdoor recreational facilities on recognised national cycling or walking routes, within nationally designated landscapes.
Medium	A valued view which generally represents a pleasing composition with some detracting features, tolerant of a degree of change, e.g. users of transport routes, orientated towards the Proposed Development, likely to be travelling for other purposes than just the view.

Class	Criteria Description
Low	Incidental and unimportant or poorly composed view with numerous detracting elements, tolerant of a large degree of change, e.g. people engaged in work activities indoors or travelling through the landscape for purposes other than the view.

8.3 Magnitude of Visual Effects

8.3.1 The magnitude of visual effects resulting from the Proposed Development at any particular viewpoint or receptor is based on the size or scale of change in the view, the geographical extent of the area influenced and its duration and reversibility. The variables involved are described below:

- The scale of the change in the view with respect to the loss or addition of features in the view and changes in its composition, including the proportion of the view occupied by the Proposed Development,
- The degree of contrast or integration of any new features or changes in the landscape form, scale, composition and focal points,
- The nature of the view of the Proposed Development, in relation to the amount of time over which it will be experienced and whether views will be full, partial or glimpses,
- The angle of view in relation to the main activity of the receptor, distance of the viewpoint from the Proposed Development, and the extent of the area over which the changes would be visible, and
- The duration of the effect (short-term, medium-term or long-term) and the reversibility of the effect (whether it is permanent, temporary or partially reversible).

8.3.2 The magnitude of visual effect resulting from the Proposed Development at any particular viewpoint or receptor is based on an interpretation of a combination of the above variables and the criteria set out in Table 8.

Table 8 Visual Magnitude Criteria

Class	Criteria Description
High	Introduction of highly incongruous development which would result in considerable change, affecting a wide extent of the view and becoming a prominent or dominant feature.
Medium	Introduction of uncharacteristic development which would result in noticeable change to a limited but important part of the view, distracting from the existing focus.
Low	Introduction of development that is not uncharacteristic which would result in a small change to a limited part of the view, unlikely to distract from the existing focus.
Very Low	Barely perceptible or not discernible change to the view.

9. Significance of Landscape and Visual Effects

9.1.1 Determination of the level and significance of landscape and visual effects has been undertaken by employing professional judgment to combine and analyse the magnitude of effect against the identified sensitivity to change for each receptor.

9.1.2 The landscape assessment takes account of direct and indirect change on existing landscape elements, features and key characteristics and evaluates the extent to which these would be lost or modified, in the context of their importance in determining the existing baseline character.

9.1.3 The visual assessment takes account of likely changes to the visual composition, including the extent to which new features would distract or screen existing elements in the view or disrupt the scale, structure, or focus of the existing view.

9.1.4 The assessment of landscape and visual effects is informed by and described using the five-point scale and definitions set out in Table 9.

Table 9 Categories of Landscape and Visual Significance of Effect

Degree of Significance	Description of Landscape Effect	Description of Visual Effect
Major	Highly noticeable change affecting key characteristics of a highly sensitive landscape, resulting in a fundamental change to its character.	Considerable change affecting a large extent of a highly sensitive view and becoming a dominant feature.
Moderate	Noticeable change affecting some key characteristics in a highly sensitive landscape or very noticeable change in a medium sensitivity landscape, resulting in a change to the overall impression of its character.	Noticeable change affecting a limited, but important part of a highly sensitive view or a wider extent of a medium sensitivity view, becoming prominent or detracting from the existing focus.
Minor	Small change affecting few characteristics in a medium to highly sensitive landscape or noticeable change to a less sensitive landscape, resulting in a limited or localised change to the impression of its character.	Small change affecting a limited and unimportant part of a medium to highly sensitive view or an important part of a less sensitive view, unlikely to distract from the existing focus.
Negligible	Very little change from baseline conditions, resulting in a barely distinguishable or indistinguishable change.	Where there is no discernible improvement or deterioration in the existing view.
No effect	The Proposed Development would not affect the landscape receptor.	The Proposed Development would not affect the view.

9.1.5 Landscape or visual effects of **Moderate or greater** are considered to be 'significant' for the purposes of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (the 'EIA Regulations').

10. Method of Assessment: Cumulative Effects

10.1.1 The approach used to determine cumulative effects has drawn on 'Assessing the Cumulative Impact of Onshore Wind Energy Developments' (SNH, 2012). This states that "Cumulative impacts can be defined as the additional changes caused by a proposed development in conjunction with other similar developments or as the combined effect of a set of developments, taken together".

10.1.2 The cumulative assessment therefore includes wind turbine developments that are operational, consented / under construction or for which a planning application has been submitted and is not yet determined or is under appeal. Wind farms at EIA Scoping or pre-application stages are not included as they are subject to change during the design process and are regarded as not sufficiently finalised to contribute to the assessment of cumulative effects. The cumulative assessment also includes consideration of medium intensity aviation lighting where present on cumulative wind farms.

10.1.3 An initial search area of 60 km from the Proposed Development was utilised for the cumulative assessment. All identified large scale wind farms within the search area, along with smaller scale and single turbine developments within 20 km where mapped. A short list of wind developments to be included within the cumulative assessments, focused on those with the potential to contribute to significant effects, was then identified through initial appraisal and consultation with ABC and NatureScot.

10.1.4 The cumulative situation changes frequently as applications are made, determined or withdrawn. Layouts of wind farms for which applications have been submitted may also change prior to being constructed. For the purposes of assessment, therefore, it is necessary to determine a cut-off date when the Development Sites to be included in a cumulative assessment are 'frozen' in terms of layout and status. The cut-off date for information considered by this cumulative assessment was 1st July 2021 and any changes in the cumulative situation after this date are not assessed. The details of cumulative wind farms (such as individual turbine locations) to be included in the assessment have been compiled from known wind farm planning applications and from information held by ABC and the Energy Consents Unit. No detailed consideration is given to the lifespan of existing wind farms as it is anticipated that the Proposed Development would be constructed before the consent of these wind farms expires and they are decommissioned.

10.2 Cumulative Baseline Scenarios

10.2.1 The SNH (2012) cumulative guidance recommends that different cumulative baseline scenarios be considered that relate to various different combinations of wind farm status.

10.2.2 The consideration of existing operational wind farms is incorporated within the assessment of baseline conditions and the resulting effects described within the non-cumulative landscape and

visual assessments. Two further scenarios are considered within the cumulative assessments, as follows:

- **Scenario 1:** The cumulative effects of the Proposed Development introduced into a baseline which includes wind farms which have been consented and/or are under construction, in addition to existing operational schemes, and
- **Scenario 2:** The cumulative effects of the Proposed Development introduced into a baseline which includes wind farms at the application stage (as at 01 July 2021), in addition to existing operational schemes and those which have been consented and/or are under construction.

10.3 Magnitude of Cumulative Effect

10.3.1 Cumulative landscape and visual effects may result from additional changes to the baseline landscape or visual resources, as a result of the Proposed Development, in conjunction with other wind turbine developments.

10.3.2 It is important to note that cumulative effects may vary from the effects of the Proposed Development considered in isolation. For example, it is possible for a scheme to have effects that are judged of relatively high significance on a particular receptor when taken on its own, but when considered together with the effects of other developments the additional *cumulative* effect of the scheme may be lower.

10.3.3 The cumulative landscape magnitude of effect and cumulative visual magnitude of effect is determined with reference to the criteria set out in Table 4 and Table 8 and include the following considerations:

- The number of visible existing and/or potentially visible proposed wind developments,
- The distance to existing and/or proposed wind developments,
- The direction and/or distribution of existing and proposed wind developments, and
- The landscape setting, context and/or degree of visual coalescence of existing and proposed wind developments.

10.4 Significance of Cumulative Effects

10.4.1 Determination of the significance of cumulative landscape and visual effects has been undertaken by employing professional judgement to combine and analyse the cumulative magnitude of effect against the identified sensitivity to change. It should be noted that the cumulative assessment is the result of the addition of the Proposed Development to the identified cumulative baseline scenario.

10.4.2 The significance of cumulative landscape and visual effects are described with reference to the criteria set out in Table 10. For the purposes of this assessment, effects of **Moderate or greater** are considered to be ‘significant’ for the purposes of the EIA Regulations.

Table 10 Categories of Cumulative Landscape and Visual Significance of Effect

Degree of Significance	Description of Landscape Effect	Description of Visual Effect
Major	The addition of the Proposed Development into the cumulative baseline scenario would result in wind turbines in the landscape becoming a dominant and character defining feature.	The addition of the Proposed Development to the cumulative baseline scenario would result in a very noticeable increase in wind turbines to the extent whereby they would become a dominating or obstructive feature within the view.
Moderate	The addition of the Proposed Development into the cumulative baseline scenario would result in wind turbines becoming locally dominant or characteristic but would not result in them becoming a character defining feature.	The addition of the Proposed Development to the cumulative baseline scenario would result in a noticeable increase in wind turbines to the extent whereby they would become prominent but would not dominate or obstruct the view.
Minor	The addition of the Proposed Development into the cumulative baseline scenario would not result in a noticeable change to key landscape characteristics.	The addition of the Proposed Development to the cumulative baseline scenario would result in a perceptible increase in wind turbines but not to the extent that they would become a prominent feature in the view.
Negligible	The addition of the Proposed Development, into the cumulative baseline scenario would not result in any discernible change to key landscape characteristics.	The addition of the Proposed Development to the cumulative baseline scenario would not result in any discernible increase in the appearance of wind turbines in the view.
No effect	The Proposed Development would not affect the landscape receptor.	The Proposed Development would not affect the view.

10.4.3 No other types of development of a similar scale to wind farms have been identified in the planning system and as such, the cumulative assessment focuses on potential cumulative effects with other wind farms only.

11. The Influence of Weather

11.1.1 Wind direction and turbine yaw angle affects visibility of the turbine rotors and blades in the landscape generally. The turbine rotors would be facing towards the prevailing wind direction most of the time. Consequently, viewers at certain locations would experience differing levels of visual change because of the proportion of the full sweep of the rotor that would be most often visible.

11.1.2 Weather and prevailing atmospheric conditions can have an influence on the visibility and impression of wind turbines, particularly from more distant locations. Changeable visibility in this region of Scotland is common due to its location near the coast, topographic variation, and incidence of haze, fog, mist and rain.

11.1.3 The Met Office website[2] provides data on the Campbeltown climate station at Campbeltown Airport / Machrihanish (approximately 18.5 km south of the Development Site). Between 1981 and 2010 there were, on average, 1412.5 hours of sunshine annually; approximately 32% of the total daylight hours for the year. Conversely, there were on average 177.7 days with >1mm rainfall, which accounts for 48% of the year. More recent average weather data from the Machrihanish Climate Station for the period up to 2020 has not yet been published. Comparison of the average weather data between 1961 and 1990 and between 1971 and 2000 with that of the 1981 to 2010 period indicates an increase in average hours of sunshine and a decrease in average days with >1mm rainfall for the most recent period.

11.1.4 The total daylight hours each year have been calculated by dividing the total number of hours per year by two ((365x24)/2). Leap years have not been allowed for. The calculation assumes that longer days in the summer months and shorter days in the winter months result in an average of twelve hours daylight per day.

11.1.5 Atmospheric conditions can also have a strong influence on the visibility of aviation lighting. As described in Appendix 7.2 (EIAR Volume 3) and in line with CAA guidance the proposed aviation lights would operate at two different intensity levels depending on the prevailing conditions. In periods or low visibility, where atmospheric conditions limit visibility to 5 km or less, the lights would be operated at peak intensity (2000 candela at source). In these conditions visibility of the lights is often likely to be restricted by cloud. In periods where atmospheric conditions result in visibility of 5 km, or greater, the lights would operate in a lower intensity mode, equivalent to 10% of the peak intensity (200 candela at source). Analysis of available historic visibility data (see Appendix 16.1: Aviation Lighting and Mitigation Report; EIAR Volume 3) indicates that the aviation lighting is likely to be operating at the lower intensity mode for upwards of 96% of the time.

11.1.6 The assessment adopts a 'worst case' approach to daytime effects which assumes clear weather conditions and good visibility. In relation to night-time effects a realistic worse case approach is taken, highlighting the theoretical, but unlikely, scenario of the lights operating at peak intensity in clear conditions, and qualifying this with the more likely scenario of the lights operating in the lower intensity mode during clear conditions, and higher intensity mode in poorer conditions.

12. Assumptions and Limitations of the Assessment

12.1.1 The duration of all operational effects is assumed to be long-term (35-year operational lifespan) and theoretically reversible upon decommissioning. This is not repeated for every receptor but is considered as part of the judgement of magnitude of change.

[2] https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-climate-averages/gcggqkdp5 (accessed 01/11/21)

12.1.2 Using a precautionary approach, and although some people may consider wind farms to be beneficial, all likely landscape and visual effects identified are judged to be adverse.

12.1.3 ZTVs, wirelines and photomontages have been provided as part of the LVIA. These are graphic tools intended to aide understanding of the assessment reporting and therefore should be read in conjunction with the assessment text and should be viewed in the field and with an understanding of their inherent limitations. Details of the use and limitations of these graphic tools are provided in Section 13, below.

12.1.4 Baseline photography has been captured over a number of years and each viewpoint visited on several occasions. Older photography has only been used for viewpoints where there have been no significant changes to the baseline, with updated photography provided where significant changes have occurred. The exception to this is Viewpoint 15 (Sound of Gigha from recreational watercraft), which uses previously captured photography with new (baseline) wind farm developments edited in. This approach was agreed with NatureScot in post-scoping advice received on 12/10/2020 (Ref: CPA160546).

12.1.5 The assessment considers potential change resulting from the addition of visible aviation lighting on eight of the proposed turbines. It was not possible to visit all viewpoint locations, and particularly those which are more remote, at night and therefore the night-time baseline described is informed by daytime observations and from targeted night-time survey focused on settlement and locations where receptors are more likely to experience views at night.

12.1.6 The assessment considers both the daytime and night-time impacts resulting from the Proposed Development. However, separate judgements for daytime and night-time are not provided, instead a worst-case approach is taken to reporting levels of value, susceptibility and sensitivity. The majority of the findings relating to these considerations are therefore based on daytime conditions, as appreciation of landscape character and the importance of views is greater during day light. A similar approach is taken for judgements of the magnitude of impact and level of effects, with night-time change considered, but in most cases the findings predominantly due to daytime change.

12.1.7 The cumulative situation changes frequently as applications are made, determined, or withdrawn. Layouts for wind farms for which applications have been submitted may also change prior to being constructed. For the purposes of the cumulative assessment, it is therefore necessary to determine a cut-off date when the sites to be included are assumed to be frozen in terms of layout and status. The cut-off date for information considered in the cumulative assessment was 1st July 2021 and any changes in the cumulative situation after this date are not assessed.

12.1.8 At the time of undertaking fieldwork for the assessment (October 2020 to June 2021) the Beinn an Tuirc III and Blary Hill wind farms were under construction. Completed turbines at these locations were not observed or captured in viewpoint photography and as such for the purpose of this assessment are not considered to be a feature of the baseline and as such are included within scenario one of the cumulative landscape and visual assessment. Similarly, it is understood that both Deucheran Hill and Beinn an Tuirc I are nearing the end of their consented period and are therefore likely to be decommissioned within approximately five years of the Proposed Development being

constructed. As there is likely to be a time period when these two schemes and the Proposed Development are present, they have been considered as part of the cumulative baseline.

12.1.9 The cumulative assessment focuses on potential cumulative effects relating to the main permanent structures and other associated features of each cumulative wind farm development. This is due to the uncertainty of the timing of construction activities for each cumulative wind farm development.

13. Visual Representation Methodology

13.1.1 The following provides details of the production and limitation of the graphic material produced in support of the landscape and visual assessments. It should be noted that they are tools to aide in understanding of the assessment and are not used to determine the potential significance of effects.

13.2 Zone of Theoretical Visibility

13.2.1 The ZTV defines the effective boundaries within which views of the Proposed Development could potentially be obtained. ZTVs have been prepared using specialist computer software, ArcGIS. This produces an analysis of a computer-based model that uses landform as the key determinant of availability or obstruction of view.

13.2.2 The landform model is based on points at 5 m intervals derived from Ordnance Survey Terrain 5 Digital Terrain Model (DTM) tiles which were not down-sampled. The ZTVs are based on a viewer height of 2 m above ground level and take account of the curvature of the earth. It should be noted that the computer model does not take into account surface features such as trees or woodland, buildings and other structures or local landform which can vary the ZTV locally and therefore the ZTV is not representative of visual effects in itself.

13.2.3 ZTVs also do not allow for the decrease in visibility that occurs with an increase in distance. Furthermore, it is important to note that there can be a wide variation in visibility shown in a ZTV, with views from different locations within the same colour banding ranging from only the tips of blades to full turbines. Nevertheless, the ZTV is a valuable tool in assisting with the identification of areas of potential visual impact. However, they must be verified in the field and used in conjunction with other visualisations to determine the actual extent of potential visibility.

13.2.4 A range of ZTV diagrams (EIAR Volume 2c) have been produced to aid in the assessment of effects and support the written report. The following provides a brief description of these ZTVs:

- Figures 7.6a and 7.6b provide ZTVs calculated from the blade tip at its highest point (i.e. the maximum height of the turbines, T1-T6 at 185m and T7, T10-T11 at 200m). Figure 7.6a is provided on 1:250,000 mapping at A3 size for ease of use and Figure 7.6b are provided on 1:50,000 mapping at A0 size to allow a more detailed indication of potential visibility. The ZTV shown in these figures are calculated beyond the 45km study area,
- Figures 7.7a and 7.7b provide ZTVs calculated from the hub height of the candidate turbine (T1-T6 at 112m and T7, T10-T11 at 132m). Figure 7.7a is provided on 1:250,000 mapping at A3 size and Figure 7.7b on 1:50,000 mapping at A0 size. The ZTV shown in both figures are calculated beyond the 45km study area,

- Figure 7.8 provides an aviation lighting ZTV, calculated from the hub height of each of the 8 turbines (T1-T4 at 112m, T7, T10-T14 at 132m) on which a medium intensity aviation light will be included. It is important to note that the ZTV does not take account of the influence of distance and atmosphere on potential visibility of lighting,
- Figure 7.9 provides an aviation lighting intensity ZTV, calculated from the hub height of each of the eight turbines with aviation lights, as above. However, an additional calculation has been applied based on the elevation and angle relative to the aviation lights, with 0° being the level of the light, +1 above the light and -1 below the light. This helps to demonstrate the influence of the angle at which the aviation lighting would be viewed as this affects their apparent intensity. The intensity calculation is based on the following:
  - +3° to 0° = 2500 to 2200 candela (cd) (peak mode) or 250 to 220 cd (lower mode)
  - 0° to -1° = 2200 to 990 cd (peak) or 220 to 99 cd (low),
  - -1° to -2° = 990 to 420 cd (peak) or 99 to 42 cd (low),
  - -2° to -3° = 420 to 220 cd (peak) or 42 to 22 cd (low),
  - -3° to -4° = 220 to 170 cd (peak) or 22 to 17 cd (low),
  - -4° and below = 170 to 0 (peak) cd or 17 to 0 cd (low).

  Further details on the influence of viewing angle and more detailed calculations of the intensity of each of the aviation lights from the assessment viewpoints is provided in Appendix 16.1: Aviation Lighting and Mitigation Report (EIAR Volume 3),
- Figures 7.13 and 7.14 provide cumulative ZTVs, comparing the potential visibility of the Proposed Development and identified cumulative wind farms. Figure 7.13 calculated based on cumulative schemes within Cumulative Scenario 1, and Figure 7.14 for cumulative scenario 2, and
- Figure 7.15 provides a cumulative lighting ZTV, comparing the potential visibility of aviation lighting on the Proposed Development and similar medium intensity (2000 candela) aviation lighting proposed as part of the Narachan Wind Farm.

13.3 Visualisation

13.3.1 The visual assessment is supported by a series of visualisations from each of the identified 25 assessment viewpoint locations and 6 supplementary viewpoints (see EIAR Volume 2d).

13.3.2 Visualisations include baseline panoramas, wireline diagrams and photomontages and have been produced in accordance with Visual Representation of Wind Farms (Version 2.2), SNH (2017) and with reference to Landscape Institute Technical Guidance Note 06/19.

13.3.3 The photography used to produce the baseline panoramas and photomontages have been taken using a Canon EOS Digital camera with a 50 mm fixed lens, mounted on a tripod at a height of approximately 1.5 m above ground level. The camera has a full frame (35 mm negative size) sensor as per good practice guidance. The photography at each location consists of a series of overlapping photographs, taken at approximately 15° intervals. Photography for night-time visualisations were captured at approximately 30mins after sunset when it is suitably dark to provide an impression of light sources within the baseline, but sufficiently light to allow the outline and broad scale landscape

features to be appreciated. Night-time photographs are taken from the same position as corresponding day time photographs to allow direct comparison.

13.3.4 Baseline panoramas showing the existing view and wirelines have been produced for the majority of viewpoints. A small number of viewpoints include a wireline only, with no baseline photograph, an approach that was agreed in consultation with NatureScot and ABC. In many instances the cumulative baseline panorama consists of more than one image, presented in separate 90° segments. The baseline panoramas are intended to show the existing view and provide landscape and visual context to each viewpoint. Due to the wide angle of view the baseline panoramas are shown in cylindrical projection. The wirelines also help to indicate the potential visibility of other identified cumulative developments.

13.3.5 A series of wireline drawings covering a 53.5° horizontal field of view have also been produced for each viewpoint. Wirelines are based on a Digital Terrain Model and as such depict a bare-ground representation of the topography and landform of the view. Wirelines therefore indicate the theoretical visibility of the proposed development without the screening effect of vegetation or buildings. These wirelines are presented in planar projection to provide a consistent representation of the wind farm.

13.3.6 Photomontage images with a 53.5° horizontal field of view have been provided for all assessment viewpoints within 20 km of the Proposed Development, with the exception of Viewpoint 3: Ardpatrick for which it was agreed with ABC that a wireline would be sufficient.

13.3.7 For each viewpoint specialist panorama stitching software was used to combine the individual photographic frames into panoramas and perform the geometric conversion to a cylindrical projection. The alignment of frames was hand checked in Adobe Photoshop.

13.3.8 Matching computer-generated wirelines are then constructed using specialist software (ReSoft© WindFarm) based upon the recorded viewpoint and camera details and the geometries of the proposed turbines. The wirelines are generated using a digital terrain model derived from the Ordnance Survey Terrain-5 5 m DTM data, with a larger scale DTM at 50 m resolution (using OS Terrain 50 DTM data) patched in where required to show distant topography. A perspective match is achieved between the computer-generated wirelines and the photographs by making careful adjustments until all major features in the image align as accurately as possible with the data available. Where appropriate, objects in the landscape such as dwellings, field boundaries, roads or electricity pylons were used as additional markers.

13.3.9 Each view is then rendered, taking into account of the conditions in the photograph and sun position at the time and date the photograph was taken. Turbine blades are shown face-on towards the location of the viewpoint to provide a worst-case view, and at random angles to represent a more realistic situation. The rendered turbines are then carefully blended into the baseline photograph and sections of turbines which would appear behind foreground features are masked to create the photomontage image.

13.3.10 Night-time photomontages are produced in a similar way but with an additional process to model and render the aviation lighting. The software uses analysis of photography of an existing red aviation light coupled with a number of other factors including the distance and elevation/ angle of view

relative to the light position and lighting manufacturer supplied details to calculate the size and provide a representation of the light from the specific viewpoint location. It is important to note that the representation of the aviation lighting in the photomontages is based on how it would appear within a photograph taken at night, in line with NatureScot guidance. This allows comparison with other existing light sources present within the baseline night-time panorama. However, it results in the light in the photomontage appearing to have a more intense and lighter coloured centre, graduating to a darker red edge. In reality, the naked eye would see the aviation lighting as a consistent red colour, therefore appearing less intense than shown in the photomontages. In addition, the human perception of light intensity over distance follows an inverse square relationship, meaning that as the distance increases, the light must spread out over a larger surface and the surface brightness decreases.

13.3.11 Each of the visualisation images are then imported into page layout software where the final information, annotation and drawing frames are applied to create the final figures. The sizes of all images are presented in accordance with SNH guidance.

13.3.12 There are a number of limitations with visualisations of wind farms that should be considered and acknowledged when using them to help inform a judgement on a proposed wind farm proposal. These include:

- A visualisation can never show exactly what the wind farm will look like in reality due to factors such as: different lighting, weather and seasonal conditions which vary through time and the resolution of the image,
- The images provided give a reasonable impression of the scale of the turbines and the distance to the turbines, but can never be 100% accurate,
- The night-time images give an impression of the lighting if captured by a photograph in, rather than how they would be perceived by the naked eye,
- A static image cannot convey turbine movement, or flicker or reflection from the sun on the turbine blades as they move,
- The viewpoints illustrated are representative of views in the area, but cannot represent visibility at all locations,
- To form the best impression of the impacts of the wind farm proposal these images are best viewed at the viewpoint location shown,
- The images must be printed at the right size to be viewed properly (260 mm by 820 mm), and
- The images should be held flat at a comfortable arm’s length. If viewing these images on a wall or board at an exhibition, the viewer should stand at arm’s length from the image presented.

RWE

Clachaig Glen Wind Farm

Environmental Impact Assessment Report

Volume 3

Technical Appendices

Appendix 7.2: Aviation Lighting

Appendix 7.2 Aviation Lighting

1. Introduction

1.1.1 In the interest of aviation safety wind turbines and other structures measuring 150m or greater in height are required to include visible lighting. The Proposed Development includes seven turbines with a maximum blade tip height of up to 185m and five with a maximum blade tip height of up to 200m and therefore, visible aviation lighting will be required. As a result, parts of the Proposed Development may be visible at night from certain inhabited and frequented locations, leading to the potential for landscape and visual effects.

1.1.2 In addition to the visible aviation lighting, and in line with Ministry of Defence requirements, infra-red lighting will also be positioned on the turbine hubs. However, this type of infra-red lighting will not be visible to the naked eye and therefore is not considered in terms of its potential impacts in the aviation assessment, and landscape and visual assessment that also accompanies the EIAR.

1.1.3 An overview of the approach to the assessment of landscape and visual effects related to lighting is included in Chapter 7 (Volume 2 of the Environmental Impact Assessment Report (EIAR)), with further details provided in Appendix 7.1 (EIAR Volume 3).

1.1.4 This appendix is intended to provide supporting information to aide understanding of the landscape and visual assessment. It provides background information related to the requirements for aviation lighting and an overview of the approach taken for the Proposed Development. It then provides a summary table indicating which of the lights, if any, would be visible from each of the identified viewpoint locations. Details of the assessment of landscape and visual effects are provided in Appendix 7.5 (EIAR Volume 3), with an overview and summary of findings presented in Chapter 7 (EIAR Volume 2a). Detailed technical information on aviation lighting is provided in Appendix 16.1 (EIAR Volume 3).

2. Statutory Requirements and Guidance

2.1.1 The statutory requirement for lighting of structures, or potential on-route obstacles, of 150m or greater in height in the UK is defined in Article 222 of the Air Navigation Order (ANO) 2016. This sets out the necessity for medium intensity steady red lights to be positioned as close as possible to the top of the structure and also the potential requirement for additional lighting at intermediate levels between the top lights and ground level.

2.1.2 The Civil Aviation Authority (CAA) Policy Statement: *Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150m Above Ground Level (2017)* provides additional guidance and clarifies the required intensity and positioning of the lighting as follows:

- Medium intensity (2000 candela (cd)) steady red aviation warning light positioned on the nacelle of the turbine, and

- At least three low intensity (32 cd) intermediate lights positioned on the turbine tower at half the nacelle height to provide 360-degree coverage.

2.1.3 The CAA policy statement also allows lighting to operate at a lower intensity (a minimum of 10% of the specified peak intensity) when the horizontal meteorological visibility in all directions from the hub height of the turbines is more than 5km. This means that the medium intensity (2000 cd) lights are permitted to be reduce to 200 cd in good atmospheric conditions, such as when there is no low cloud cover, mist or fog, or rain or snow at or around the hub height of each turbine.

2.1.4 The International Civil Aviation Organization (ICAO) provides further information in relation to aviation obstruction lighting in Annex 14 to the Convention on International Civil Aviation. This sets out the minimum intensity of lights at different vertical angles relative to the lighting horizontal plane (i.e. the nacelle level for the Proposed Development). For the medium intensity (2000 cd) aviation lights the minimum requirements are:

- 1500 cd at a vertical angle of zero degrees (when the viewer is at the same level as the light), and
- 750 cd at a vertical angle of -1 degrees (when the viewer is 1 degree below the level of the light)

2.1.5 The above minimum figures are based on the lights when operating at peak intensity (2000 cd mode). When atmospheric conditions allow the lights to be operated on the lower intensity mode (200 cd) these minimums would also reduce to 10% (i.e. 75 cd at -1 degrees). There are no specified minimum intensities for vertical angles lower than -1 degrees, allowing some flexibility in design.

3. Proposed Aviation Lighting

3.1.1 The following provides an overview of the approach to aviation lighting for the Proposed Development. Further detail, including more technical information on lighting is provided in Appendix 16.1: Aviation Lighting and Mitigation Report (EIAR Volume 3).

3.1.2 The approach to aviation lighting for the Proposed Development has been to follow the requirements set out in the ANO and by the CAA to ensure aviation safety, while also seeking to minimise potential environmental effects. The design process has considered a number of potential mitigation measures to reduce landscape and visual effects of lighting, including:

- Turbine layout,
- Reduction of the number of lights,
- Light unit design and controls, and
- Radar Activated Lighting.

3.2 Turbine Layout

3.2.1 The potential for landscape and visual impacts of aviation lighting was considered as part of the turbine layout design process. This largely involved seeking to minimising the visibility of turbine hubs from the lower level coastal strip to the east and west of Kintyre as this is where the majority of visual

receptors are located. In addition, potential views from Arran, and particularly low-level locations where the majority of settlement and therefore potential night-time receptors are located, were considered. More broadly, the site selection process, informed by RWE's viewshed analysis (Figure DS-1; Design Statement) has ensured that potential visibility of the Proposed Development is limited from settlement on Kintyre and within the nationally designated area of north Arran.

3.2.2 The aviation lighting Zone of Theoretical Visibility (ZTV) (Figure 7.8, EAIR Volume 2c) demonstrates that theoretical visibility of the aviation lighting from Kintyre would be limited, with most areas, including the majority of settlement and roads, where people are most likely to be at night, receiving no visibility.

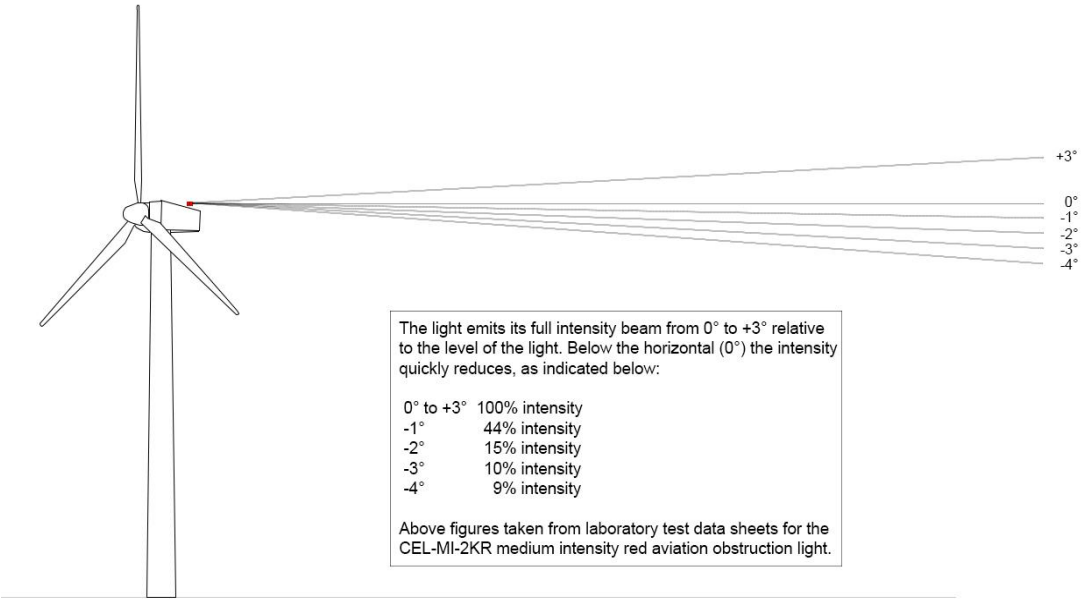
3.3 Reduction in Number of Lights

3.3.1 The CAA has recently indicated that it may not always be necessary to light all of the turbines within a wind farm. Where this approach is possible the lighting design would involve lighting of a selection of the turbines, focused on those along the perimeter and/ or those at a higher elevation.

3.3.2 Through consultation with the CAA a reduced scheme of aviation lighting has been agreed for the Proposed Development, following the robust perimeter approach. Various alternative lighting arrangements were considered and evaluated, leading to the identification of an optimum solution with lighting on eight turbines, as detailed in Appendix 16.1: Aviation Lighting and Mitigation Report (EIAR Volume 3). In addition, it is anticipated that an agreement with the CAA will be reached to allow omission of the intermediate tower lighting, further reducing the number of lights.

3.4 Light Unit Design and Controls

3.4.1 In addition to minimising the number of aviation lights required and reducing the extent of their theoretical visibility through layout design using the viewshed site finding methodology, consideration has been made as to the design of the aviation obstruction lighting unit itself. Aviation lighting manufacturers are now producing lights with tightly controlled focusing. The candidate lighting unit for the Proposed Development is designed to produce a narrow, focused beam of light, with the greatest intensity between 0 and 3 degrees relative to the level of the light. This helps to avoid skyglow effects experienced with other types of lighting, such as older types of street lighting, and also reduces downward light spill. The result of this is that the light intensity quickly reduces at lower vertical angles relative to the position of the lights. The following diagram provides an illustration of the reduction in intensity at different angles based on the candidate medium intensity aviation obstruction light (CEL-MI-2KR) produced by a leading manufacturer.



3.4.2 The Proposed Development is located within the upland interior of Kintyre, and the majority of nearby landscape and visual receptors are at lower levels, often at or very close to sea level. This means that from the limited locations on the Kintyre Coast, Gigha and Gigha Sound where the lighting is visible the vertical angle of the view towards the lighting would be -1 degrees, or lower. The lighting intensity ZTV (Figure 7.9, EIAR Volume 2c) indicates that from many locations where the lighting would be visible, the apparent intensity of the lights would be much reduced. To provide an example, at Viewpoint 8: Ardminish, Isle of Gigha, the vertical angle to the proposed aviation lighting would range between -1.8 and -2.3, resulting in a reduced lighting intensity of between 333 and 484 cd, when operating at peak intensity and 33 to 48 cd in the lower intensity mode. Table 1 below provides further details of the vertical angle and light intensity for each light from Viewpoint 8.

Table 1 Theoretical Lighting Intensity from VP8: Ardminish, Gigha

Turbine	Distance from viewpoint (km)	Elevation (relative to light position)	Light Intensity at viewpoint in peak intensity mode (cd)	Light Intensity at viewpoint in low intensity mode (cd)
T1	9.1	-2.3°	333	33
T2	10.0	-2.2°	357	36
T4	8.9	-2.0°	413	41
T7	9.9	-2.1°	385	39
T10	9.2	-1.8°	484	48
T11	9.7	-1.8°	484	48
T13	10.2	-1.8°	484	48
T14	9.7	-1.8°	484	48

3.4.3 It is important to note that the intensity values in Table 1 do not take into account the distance and atmospheric filtering between the light and the viewpoint location, and therefore in reality the intensity of lighting experienced at that location would be further reduced. Furthermore, Viewpoint 8 is in excess of 8.9km from the nearest lit turbine and as such the lights would generally be seen only during good weather conditions when they are in the lower intensity setting. Further details of the data and calculations made to determine the values in the above table and for each of the assessment viewpoints are provided in Appendix 16.1: Aviation Lighting Mitigation Report (EIAR Volume 3). In order to aide understanding details of approximate illuminance of a range of common light sources often experienced within the study area are also provided in Appendix 16.1.

3.4.4 The proposed lighting would be fitted with sensors to monitor the surrounding atmospheric conditions. When good conditions (visibility greater than 5km in all directions) are present the lighting would automatically switch to a lower intensity mode, 10% of the peak intensity, in line with CAA policy guidance. This will mean that in periods of good visibility the intensity of the lighting, and therefore potential landscape and visual effects, would be reduced. In poor atmospheric conditions, when visibility is less than 5km from the hub of a turbine, the lighting would be in the higher intensity mode. However, in this scenario the lighting would often be at least partially obscured, particularly from locations greater than 5km. An evaluation of historic weather (visibility) data is provided in Appendix 16.1: Aviation Lighting and Mitigation Report (EIAR Volume 3) and this indicates that for the majority of the time when the proposed aviation lighting is visible it will be operating at the lower intensity (10%) mode.

3.5 Radar of Transponder Activated Lighting

3.5.1 It may be possible in some circumstances to include an aircraft proximity warning system as part of a wind farm design. These systems use radar to detect the presence of approaching aircraft and then activate the aviation obstruction lighting. This allows the aviation lighting to be switched off for the majority of time, only activating when an aircraft approaches, therefore minimising potential landscape and visual effects.

3.5.2 These systems are now in use in wind farms in Europe and North America, often in flat landscapes where radar coverage can be high by utilising just a single radar, unlike at Clachaig Glen where terrain shielding would be large and thus multiple radars would be required to create the same coverage as one single radar in a flat landscape.

3.5.3 It is also important to note, radar activated lighting systems have not yet been approved for use in the UK by the CAA and as such cannot currently be developed for the Proposed Development. The potential for including this type of system as part of the Proposed Development will be considered in more detail once the CAA is in a position to provide further guidance.

3.5.4 A similar system that detects the presence of aircraft transponders may also be possible in the future. It would likely operate in a similar way to the radar activated system, allowing the lights to be switched off for the majority of the time and only activating when an aircraft approaches. Aircraft transponders are not currently required for all types of aircraft in the UK and as such this type of system cannot currently be incorporated into the Proposed Development but could be considered in the future if aircraft regulations where to change.

4. Summary of Potential Visibility of Proposed Aviation Lighting

4.1.1 Table 2, below, provides details of the number of lights, if any, that are potentially visible from each of the visual assessment viewpoints. **X** indicates that a light is potentially visible, and **F** indicates that the light is theoretically visible, but screened by forestry. The stated distance for each viewpoint refers to the distance to the nearest turbine with a light, irrespective of its potential visibility.

Table 2 Potential Visibility of Aviation Lighting of Assessment Viewpoints

Viewpoint (and distance)	Turbine Number (and maximum tip height)							
	T1 (185m)	T2 (185m)	T4 (185m)	T7 (200m)	T10 (200m)	T11 (200m)	T13 (200m)	T14 (200m)
VP1: Craighouse, Jura (31.1 km)	X	X	X	X	X	X	X	X
VP2: B8024 south of Kilberry (18.6 km)	X	X	X	X	X	X	X	X
VP3: Ardpatrick (15.2 km)	-	-	-	-	-	-	-	-
VP4: A83 north of Clachan (15.5 km)	F	X	F	-	-	-	-	-
VP5: Dun Skeig (14.6 km)	X	X	X	F	-	-	-	-
VP6: Kennacraig – Port Ascaig Ferry (14.9 km)	X	X	X	X	X	X	X	X
VP7: Kennacraig – Port Ellen Ferry (18.4 km)	X	X	X	X	X	X	X	X
VP8: Ardminish, Gigha (8.9 km)	X	X	X	X	X	X	X	X
VP9: South Pier, Gigha (8.0 km)	X	X	X	X	X	X	X	X
VP10: Sound of Gigha, from Gigha ferry (6.0 km)	X	X	X	X	X	-	-	-
VP11: Rhunahaorine/Point Sands (6.0 km)	X	-	X	-	-	-	-	-
VP12: Tayinloan ferry terminal (4.4 km)	X	-	-	-	-	-	-	-

Viewpoint (and distance)	Turbine Number (and maximum tip height)							
	T1 (185m)	T2 (185m)	T4 (185m)	T7 (200m)	T10 (200m)	T11 (200m)	T13 (200m)	T14 (200m)
VP13: Kintyre Way north of the Development Site (1.7 km)	X	X	-	X	-	F	X	F
VP14: A'Chleit (2.8 km)	-	-	-	-	-	-	-	-
VP15: Sound of Gigha from recreational watercraft (6.1 km)	X	X	X	X	X	X	X	X
VP16: North Muasdale (3.3 km)	X	X	X	X	X	X	F	X
VP17: A83 south of Muasdale (4.6 km)	-	-	-	-	-	-	-	-
VP18: Glenacardoch (6.2 km)	F	-	X	-	F	-	-	-
VP19: Beinn an Tuirc (6.2 km)	X	X	X	X	X	X	X	X
VP20: A83 near Bellochantuy (10.3 km)	-	-	-	-	-	-	-	-
VP21: Lochranza – Claonaig ferry (20.3 km)	-	X	-	-	-	-	-	-
VP22: Newton Point, Arran (21.9 km)	-	X	-	-	-	-	-	-
VP23: A841 Whitefarland, Arran (13.6 km)	-	X	-	-	-	-	-	-
VP24: Beinn Bharrain, Arran (16.4 km)	X	X	X	X	X	X	X	X
VP25: Goatfell, Arran (26.1 km)	X	X	X	X	X	X	X	X

4.1.2 A range of factors, including distance, atmospheric conditions, intensity of lights and the vertical angle of the view influence the potential landscape and visual effects of visible lights. As detailed in Appendix 7.1 (EIAR Volume 3) consideration of lighting in the landscape and visual assessment takes a 'worst case' approach based clear visibility and on the assumption that the lights are operating at peak intensity. It is important to note that this approach tends to overstate the likely change experienced for the following reasons:

- the higher intensity (2000 cd) mode of the lighting is only intended to be used during periods of poor atmospheric conditions and visibility, during which times some or all of the lights are likely to be at least partially obscured,
- the full intensity of the lighting, either in the peak (2000 cd) or reduced (200 cd) mode, would only be seen by people at locations that are at the same level or above the light. Those at lower

levels looking up at the light would experience lower intensity levels. In the case of the Proposed Development the majority of locations frequented by people at night and from where the lights would be visible are at lower levels, and

- The intensity of lighting, and therefore impression of change, also reduces with distance due to a range of factors, including filtering of light by the atmosphere. The majority of the viewpoints from which the lights would potentially be visible are greater than 5km from the nearest turbine with an aviation light, with many of those being 10km or greater.

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Appendix 7.3: North Arran National Scenic Area Special Landscape Qualities Assessment

Appendix 7.3 North Arran National Scenic Area Special Landscape Qualities Assessment

1. Introduction

1.1.1 This technical appendix provides an assessment of impacts on the North Arran National Scenic Area (NSA) resulting from the Proposed Development. This assessment has been prepared in response to post-scoping advice received from NatureScot and follows the steps and approach set out in Guidance for Assessing the Effects on Special Landscape Qualities, NatureScot (Working Draft 11, 2018).

1.1.2 An assessment of effects on the North Arran Special Landscape Area and relevant Landscape Character Types is provided in Chapter 7 (EIAR Volume 2a) and Appendix 7.5 (EIAR Volume 3). In addition, a separate Wild Land Assessment for the North Arran WLA is provided in Appendix 7.4 (EIAR Volume 3).

2. Step 1: The Proposal

2.1.1 A description of the main elements of the Proposed Development with the potential to result in landscape and visual effects is provided in Chapter 7: Landscape and Visual Assessment (EIAR Volume 2a). A more detailed description of each element of the Proposed Development is provided in Chapter 3: Project Description (EIAR Volume 2a).

3. Step 2: The Study Area

3.1 The relationship of the proposal to the designated landscape (within or outside)

3.1.1 The Proposed Development would be located outside the NSA, approximately 11.5 km to the west at its closest point, as shown on Figure 7.4 (EIAR Volume 2c).

3.1.2 The Zone of Theoretical Visibility (ZTV) diagrams (Figures 7.6 and 7.7, EIAR Volume 2c) indicate potential for visibility of the Proposed Development from parts of the North Arran NSA. The pattern of potential visibility is fragmented and largely limited to the western edge of the NSA and localised patches of higher west facing slopes and higher summits in the east. From the majority of the NSA there would be no visibility of the Proposed Development.

3.2 Description of the study area and how it has been defined

3.2.1 The North Arran NSA and associated special qualities are described and defined within: *The special qualities of the National Scenic Areas*, Scottish Natural Heritage (2010). The published landscape character assessment for the area is the *North Ayrshire Landscape Wind Capacity Study* (2018), although reference should also be made to the more recently published *National Landscape Character Assessment*, SNH (2019).

3.2.2 The majority of the identified Special Landscape Qualities (SLQ) of the NSA relate to physical and perceptual attributes which are experienced from within the boundary of the NSA. The exception to this is '*a mountain presence that dominates the Firth of Clyde*' which is appreciated from parts of the south of Arran, outside the NSA and more distant locations, including the north Ayrshire coast, the Isle of Bute and the east of Kintyre.

3.2.3 The Proposed Development would be located towards the west of the upland interior of Kintyre, and as such there would be very few, if any, locations on Kintyre where the Proposed Development would be seen in the foreground of the view to Arran, as is evidenced by the visual assessment viewpoints. It is therefore considered that the Proposed Development would have little influence on the appreciation of this SLQ. For this reason and taking account of the nature of the remaining SLQs, the study area for this assessment is defined as the outer extent of the North Arran NSA boundary.

3.3 How the NSA is used and experienced by people

3.3.1 The Isle of Arran has a strong presence within the Firth of Clyde, with its dramatic mountains in the north acting as a focus to views across the sea from the mainland and other nearby islands.

3.3.2 The North Arran NSA covers much of the northern half of the Isle of Arran, including its coastal waters. The settlement of Lochranza lies to the north-west of the island and scattered housing and small clusters of dwellings are found along much of the low-lying coastline within the NSA. The settlements are linked by the A841 that circles the island. Lochranza has a ferry terminal that runs a service to Claonaig or Tarbert on the Kintyre mainland.

3.3.3 The mountainous interior of Arran is a popular destination for visitors and walkers, in particular the high summits to the east. The narrow, settled coast around the edge of the hills is the main focus of activity with settlement and transport routes largely restricted to this area, in contrast to the less settled interior. There is a strong contrast between the low-lying settled coastline and activity on the coastal waters, and the unsettled, mountainous interior (recognised through its identity as a Wild Land Area).

3.3.4 The NSA includes the coastal waters to the west of the island within the Kilbrannan Sound, and to the east within the Firth of Clyde. These parts of the NSA are likely to be used by recreational watercraft, and form part of the experience of arriving at Arran by ferry from the Kintyre mainland.

3.3.5 At night, the main focus of activity is along the coast in and around settlements and along the main transport routes. The challenging terrain of the hills and interior of the NSA reduce accessibility into this area at night and as such it is frequented by relatively few people. The appreciation of many of the SLQs is reduced somewhat at night, although the dark outline and mass of the hills and

mountains still has a presence and the lack of light sources within the interior reinforces the contrast to the settled coast and mainland beyond. From the Arran coast, both foreground light sources in settlements and distant lights on the mainland are present.

4. Step 3: The Assessment

4.1.1 In order to ensure a targeted and proportionate approach to the assessment an initial appraisal was undertaken to determine which of the identified SLQs of the North Arran NSA would potentially be influenced by the Proposed Development. This appraisal stage involved desk-based research, including analysis of mapping, ZTVs and wirelines, and targeted field survey to gain an understanding of each of the SLQs and the underpinning landscape characteristics. A number of locations were visited along the coast and within the interior of the NSA. Table 1 provides a summary of the findings along with a reason for inclusion and/or justification for scoping out the SLQ from further assessment.

4.1.2 The LVIA presented in Chapter 7 of the EIAR (Volume 2a) includes a number of viewpoints (VP21 to VP25) and supplementary cumulative wirelines (CW1 to CW4) from the North Arran NSA which give an impression of the range and context of likely views towards the Proposed Development.

Table 1 North Arran NSA initial review of SLQs

SLQ	Approach and justification
A mountain presence that dominates the Firth of Clyde	Not included in assessment. The location of the Proposed Development towards the west of Kintyre results in few locations where the proposed turbines would be seen within views towards Arran and the NSA. From the very limited locations where this could potentially occur the Proposed Development would be a small background feature which would not influence the appreciation of this SLQ.
The contrast between the wild highland interior and the populated coastal strip	Not included in assessment. This SLQ relates to an experience of the changing landform and landcover between the settled coast and unpopulated upland landscapes of the interior of the North Arran NSA. The Proposed Development would be located outwith the NSA, on the mainland across the Kilbrannan Sound and as such would not affect an appreciation of this SLQ.
The historical landscape in miniature	Not included in assessment. The Proposed Development is located outwith the NSA and as such would not result in the loss of any historic features or influence the appreciation of the many different periods of historic land use.

SLQ	Approach and justification
A dramatic, compact mountain area	Not included in assessment. Although the Proposed Development would be visible from localised areas of the higher slopes and summits of the Arran mountains it would be seen in the context of other existing wind farms on Kintyre and on the mainland more broadly. The Proposed Development would not alter the physical attributes of this landscape, the impression of the mountains when seen from the surrounding lowlands and coast or have any influence on the identified key first experience of the island on approach to Brodick from the mainland. Outward views experienced from the mountains are considered in relation to *an exceptional area for outdoor recreation*, below.
A distinctive coastline with a rich variety of forms	Not included in assessment. This SLQ is largely focused on the coastline and coastal landscape of the North Arran NSA. The Proposed Development would be partially visible from a section of the western coastline, although generally seen in the context of more notable existing wind farms and clearly separated from the NSA by the Kilbrannan Sound and landform of Kintyre.
One of the most important geological areas in Britain	Not included in assessment. This SLQ concerns an experience of the changing and unique geological features of the Isle of Arran. The introduction of the Proposed Development is judged not to affect an appreciation of this SLQ.
An exceptional area for outdoor recreation	**Included in assessment.** Although not influencing access to outdoor recreation, the Proposed Development would be visible from the summits of the western mountains, and the outward facing slopes of the less popular western mountains and as such has some potential to affect this SLQ.
The experience of highland and island wildlife at close hand	Not included in assessment. This SLQ concerns an experience of the unique flora and fauna of the Isle of Arran. The introduction of the Proposed Development is judged not to affect an appreciation of this SLQ.

4.2 Assessment of Effects on 'An exceptional area for outdoor recreation' SLQ

Underpinning landscape characteristics and description of SLQ

4.2.1 The Isle of Arran is a popular tourist destination, in part because of the attraction of the mountains and coast which contribute to the NSA. The majority of activity within the NSA is focused on the coastal strip where settlement and main routes are located.

4.2.2 The mountainous interior of Arran is a popular destination for visitors and walkers, in particular the high summits to the east, including Goatfell. This area is characterised by steep topography and mountains, divided by deeply cut and enclosed valleys and a general lack of settlement or development. The enclosed interior has a strong sense of remoteness, contrasting with the settled

coast. Outward views from elevated locations include settlement and development along the coast of Arran, and on the more distant mainland. The presence of the dramatic eastern mountains in views from the mainland and from the coast of Arran, the rugged appearance of the serrated peaks and ridges, and their readiness of access due to the close proximity to Brodick increases their popularity. The more rounded and less dramatic western hills are generally less accessible and tend to be less popular than the eastern mountains.

4.2.3 Along the outer edge of the NSA the landscape is generally smaller scale with a greater complexity of land use. This area is more settled and includes the main transport routes around the island. Part of the Arran Coastal Way circles the coastal edge around the north of the island within the NSA. There are also several Core Paths within the NSA which generally extend from settlements to the coast and lower lying hills to the east of the island. However, they also provide several popular tourist routes connecting from the coast into the rugged peaks and mountains, particularly in the east.

4.2.4 The NSA extends slightly beyond the coast into the coastal waters, including the enclosed Kilbrannan Sound in the west and the more open expansive Firth of Clyde to the north and east.

4.2.5 At night, outdoor recreation is likely to be more limited and generally focused along the coast, in and around settlements. The challenging nature of the terrain of the mountains reduces accessibility into this area at night. Outward views from the interior at night include a range of light sources, primarily along the settled coast, but also including boats and beacons within the surrounding waters and more distant lights on the mainland and other islands in the Firth of Clyde and beyond.

Impacts on the underpinning characteristics and the effects on SLQ

4.2.6 The NSA Special Qualities are judged to have High value in the context of this assessment.

4.2.7 The nature of this special quality, which is focused on outdoor recreation, and the existing context of development and wind farms within outward views results in a Medium susceptibility to external change. The sensitivity of this SLQ to the type of change proposed is judged to be **High**.

4.2.8 Changes during construction would be of short duration. Taking into account the separating distance of some 11.5 km, the presence of operational wind farms and other human activity (e.g. forestry) within the interior of the Kintyre peninsula, the influence of the Proposed Development on this SLQ during construction is judged to be **Very Low.**

4.2.9 During operation the Proposed Development would be visible from localised parts of the west of the NSA, and more limited areas of the highest summits in the east. As indicated by the ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) there would be no visibility of the Proposed Development from the majority of the NSA, including from the more remote interior and many of the Core Paths and recreational routes.

4.2.10 Where receptors engaged in outdoor activity gain an appreciation of the Proposed Development, it would often have an obvious visual relationship to other less distant and more pronounced operational wind farms along the interior of the Kintyre peninsula as seen from the seascape (Viewpoint 21, Figure VP21.2, EIAR Volume 2d), coastal lowlands (see Viewpoints 22 and 23, Figures VP22.2 and VP23.2, EIAR Volume 2d), western hills (see Viewpoint 24, Figure 24.2, EIAR

Volume 2d) and high eastern summits (see Viewpoint 25, Figure 25.2, EIAR Volume 2d) within the NSA. As indicated by the ZTVs and visualisations from Viewpoints 22 and 23, visibility of the Proposed Development from the settled coast is generally limited to the tops of a small number of turbines. A greater proportion of the Proposed Development would be visible from the more elevated slopes and summits of localised parts of the interior, although at a slightly greater distance and seen within broad panoramic views. In each case although the Proposed Development would add a further wind farm into the background of the view, the existing context of other closer and more prominent wind farms, the separating influence of the Kilbrannan Sound and the distance would limit the sense of change to the character or impression of this SLQ.

4.2.11 The lighting ZTV (Figure 7.8, EIAR Volume 2c) indicates a similar, although slightly reduced pattern of visibility of the aviation lighting in comparison to the daytime ZTVs. Where visible, the proposed aviation lighting would be seen in most instances in the context of other existing light sources, including along the Arran and Kintyre coasts and within the Kilbrannan Sound. The Proposed Development would add further light sources into this context, at a distance of over 11 km and clearly external and separated from the NSA. Night-time photomontages from Beinn Bharrain (Figures VP24.5 and VP24.6) are provided in EIAR Volume 2d. It is important to note that as a result of the distance from the turbines, in clear conditions when the lights are visible, they would be operating on the lower intensity mode, as illustrated by Figure VP24.6. From the settled coast, where the focus of outdoor recreation would be at night, visibility would be limited to one aviation light from localised locations, with the majority of areas unaffected.

4.2.12 Overall, the Proposed Development is judged to have a **Low** magnitude of effect on this SLQ.

Cumulative effects on the SLQ

4.2.13 As outlined in the methodology (Appendix 7.1, EIAR Volume 3), the assessment of cumulative effects contained in the LVIA is based on two cumulative baseline scenarios, as follows:

- **Scenario 1:** The cumulative baseline for this scenario includes consented and under-construction wind farms in addition to existing operational schemes; and,
- **Scenario 2:** The cumulative baseline for this scenario includes schemes at application stage in addition to operational, consented and under-construction schemes

4.2.14 Wind farms at the scoping or pre-application stage are not considered in the cumulative assessment due to the indicative nature of these schemes and the lack of certainty they will progress to the application stage. Cumulative schemes included in the assessment are listed in Table 7-6 of Chapter 7 of the EIAR (Volume 2a).

Scenario 1:

4.2.15 The majority of the identified cumulative schemes would be visible and more prominent from parts of the NSA, and particularly west facing slopes and hill summits, as indicated by the Cumulative ZTV (Figure 7.13, EAIR Volume 2c). Visibility of some of the cumulative schemes would be more limited from the lower level coastal area of the NSA, although those closer to the east of Kintyre, such as Cour and High Constellation, would be notable features in outward views.

4.2.16 The Proposed Development would be located towards the west of the Kintyre interior and therefore at slightly greater distance than some of the more notable cumulative schemes. It would add a further wind farm into views, from some locations appearing as a minor extension to the existing schemes and from more elevated locations appearing as a distinct and more distant cluster.

4.2.17 As a result of this existing context of wind development on Kintyre and the intervening distance, the Proposed Development would result in little, if any, additional change to the experience or appreciation of *an exceptional area for outdoor recreation* SLQ. The cumulative magnitude of change is considered to be **Very Low**.

Scenario 2:

4.2.18 This scenario sees the addition of the Narachan and Sheirdrim wind farms to the cumulative baseline, both located on Kintyre. Where visible, the Narachan scheme would often be a relatively prominent feature within outward views, particularly from the western slopes of the NSA, often appearing to enlarge the group formed by Cour and High Constellation. Aviation lights on each of the Narachan turbines would also be visible adding to the existing context of lights along the coast and within Kilbrannan Sound.

4.2.19 The Proposed Development would be visible from a smaller extent of the NSA than the cumulative schemes and would not result in any additional areas of visibility. It would add to the existing context of wind farms on Kintyre and increase the number of aviation lights visible from localised areas, although at a greater distance and less prominent than other schemes. As with Scenario 1, the magnitude of cumulative change on this SLQ is judged to be **Very Low**.

Mitigation measures and level of residual effects on SLQs

4.2.20 The original site selection process for the Proposed Development was guided away from locations of national level landscape and other environmental designations using RWE's viewshed site selection process. This helped to ensure the basis for the siting and design of the scheme was one which sought to minimise, and where possible avoid, potential adverse effects on NSAs. Mitigation measures in relation to the North Arran NSA are therefore embedded in the site selection and design process of the Proposed Development. The level of effect described here is therefore residual.

4.2.21 Views of the Proposed Development would introduce further variety and number of turbines along the interior of the Kintyre peninsula, some 11.5 km to the west of the NSA. The proposed turbines and associated aviation lighting would not detract from the drama of the expansive and varied views of the NSA that are available from outdoor recreational routes and locations both within and outside the NSA. It would add a further feature in outward views, although appreciated as an external element clearly separated from the NSA. The Proposed Development would therefore result in limited change to the appreciation of *an exceptional area for outdoor recreation* experienced in relation to the North Arran NSA.

4.2.22 The level of effect on this SLQ as a result of construction activity would be **Negligible (not significant)**. During operation the level of effect on this SLQ is judged to be **Minor (not significant)**, with areas along the settled coast likely to experience a reduced level of effect. Cumulative effects in relation to Scenarios 1 and 2 would be **Negligible (not significant)**.

5. Step 4: Summary of Effects on SLQs and Implications for the Wider North Arran NSA

5.1.1 Mitigation is embedded through the location of the Proposed Development and siting of the proposed turbines and scheme components.

5.1.2 Initial appraisal informed by desk-based research and targeted site survey identified little or no potential for the Proposed Development to influence an appreciation of the majority of the identified SLQs of the NSA. The detailed assessment therefore focused on one SLQ, *an exceptional area for outdoor recreation*, concluding a **Negligible (not significant)** effect during construction, a **Minor (not significant)** effect during operation and **Negligible (not significant)** effect in relation to cumulative scenarios 1 and 2.

5.1.3 On balance, considering the limited nature of potential change on one SLQ, and no effects on the remaining SLQs, the overall significance of effect on the North Arran NSA would be **Negligible (not significant)**.

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Appendix 7.4: Wild Land Assessment

Appendix 7.4 Wild Land Assessment

1. Introduction

1.1.1 This Appendix provides an assessment of potential effects of the Proposed Development on identified Wild Land Areas (WLAs) and has been prepared in response to post-scoping advice received from NatureScot on 12th October 2020.

1.1.2 WLAs are defined in SNH's 'Wildness in Scotland's Countryside Policy Statement No. 02/03' as:

"*uninhabited and often relatively inaccessible countryside where the influence of human activity on the character and quality of the environment has been minimal.*"

1.1.3 The Scottish Government's NPF3 recognises wild land as a nationally important asset and indicates that these areas should be protected[1]. Scottish Planning Policy (SPP) also recognises the value and importance of wild land and requires that development plans identify and safeguard the character of wild land areas defined by NatureScot. In relation to spatial planning for wind farms, SPP identifies WLAs within Group 2: Areas of significant protection. This is a level below the protection given to National Parks and National Scenic Area but identifies the need to limit significant effects on WLAs.

2. Methodology

2.1.1 This Wild Land Assessment is based on the approach and principles set out in Assessing impacts on Wild Land Areas – technical guidance, NatureScot (2020).

2.1.2 Further guidance and sources of information used in the preparation of this Wild Land Assessment are identified below:

- Descriptions of Wild Land Area – North Arran (03) Wild Land Area, SNH (2017),
- Wild land areas 2014 comparison with Core areas of wild land 2013, SNH (2014),
- Core Areas of Wild Land 2013 Map: Advice to Government 16th June 2014, SNH (2014),
- Mapping Scotland's Wildness, SNH (2013),
- Wildness in Scotland's Countryside, Policy Statement No. 02/03, SNH (2003),
- Assessing the cumulative impact of onshore wind energy developments, SNH (2012),
- Spatial Planning for Onshore Wind Turbines – natural heritage considerations, Guidance, SNH (2015),
- Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA), Landscape Institute and the Institute of Environmental Assessment (2013), and
- Ordnance Survey maps and Digital Terrain Models (DTM).

[1] NPF3, Section 4.4, p42

2.1.3 It is important to note that the LVIA (Chapter 7, EIAR Volume 2a) includes an assessment of potential visual effects from two locations within the North Arran WLA: Beinn Bharrain (Viewpoint 24), and Goatfell (Viewpoint 25). The LVIA also assesses potential effects on the North Arran National Scenic Area, North Arran Special Landscape Area and landscape character types that fall within the same geographic area as the North Arran WLA. NatureScot technical guidance (2020) states (p.1, para.4):

"*The method described employs the general approach and principles set out within the Guidelines for Landscape and Visual Impact Assessment (GLVIA). The assessment of effects of a proposal on a WLA is an exercise distinct from landscape and visual impact assessment (LVIA) that can draw on but should not duplicate its information."*

2.1.4 Thus, while information from the LVIA has been referred to in the preparation of this Wild Land Assessment readers should note that the findings of both assessments are not directly comparable as each follows a distinct methodology.

2.1.5 The Wild Land Assessment follows the summary structure recommended in the NatureScot (2020) technical guidance:

1. Define the study area and scope of assessment,
2. Establish the baseline by identifying the key attributes and qualities of the WLA, and those likely to be significantly affected by the proposal,
3. Assess sensitivity by identifying which wild land qualities of the WLA, including the physical attributes and perceptual responses that contribute to those qualities, are most sensitive to the type and scale of change proposed. NatureScot (2020) technical guidance notes (p.5, para.21) "*Sensitivity is a combination of the nationally important value attached to WLAs and susceptibility to the type of change proposed. Susceptibility should take into account any evidence of past or current use and how they enhance or detract from the qualities*.",
4. Assess the potential effects by considering how the size or scale of change, extent and duration may impact upon individual attributes and qualities and/or combinations of attributes and qualities, drawing out which physical attributes and perceptual responses will be affected and how, and
5. Judgement of the significance of effect.

3. Study Area and Scope of Assessment

3.1.1 The Proposed Development is not located within, or in close proximity to, any Wild Land Areas.

3.1.2 The Jura, Scarba Lunga and Garvellachs WLA has been 'scoped out' of this assessment. It has been judged that the fragmented theoretical visibility experienced over an intervening distance of over 32 km is unlikely to result in significant effects on any of the key attributes or perceptual responses of this WLA.

3.1.3 The closest WLA, and focus of this assessment, is the North Arran WLA. At its closest point the North Arran WLA lies approximately 15 km to the east of the nearest proposed turbine. The location of the North Arran WLA and the Blade Tip ZTV is shown on Figure A7.4.1 (EIAR Volume 2c).

3.1.4 NatureScot (2020) technical guidance states (p.1, para 4) *"The assessment should consider effects on the physical attributes and perceptual responses that contribute to the WLA qualities identified in the WLA descriptions"*. Since the Proposed Development is entirely located outside the WLA further assessment of potential effects on physical attributes of the WLA has been scoped out. As such, this assessment focuses on perceptual responses that contribute to the WLA qualities identified in the North Arran (03) Wild Land Area description.

3.1.5 In order to ensure a targeted and proportionate approach to the assessment an initial appraisal was undertaken to determine which of the defined key attributes and perceptual qualities of the North Arran WLA would potentially be influenced by the Proposed Development. Table 1 provides a summary of the findings along with a reason for inclusion and/or justification for scoping out the attribute and/or perceptual response from further assessment.

Table 1 North Arran WLA attributes and perceptual responses

Key attributes and qualities of the wild land area[2]	Rationale for inclusion or exclusion from further assessment
A readily accessible area, but with strong wild land attributes, especially within the remote interior	**Included in assessment**. There is theoretical visibility of the Proposed Development within parts of the WLA that could result in changes to the perceptual response of a *sense of sanctuary and solitude*. The Proposed Development is likely to have little or no influence on other perceptual responses associated with this attribute and as such they have not been considered further.
The contrast in experience between the rugged east and smoother and more remote west mountain ranges	**Included in the assessment at the request of NatureScot**. There is theoretical visibility of the Proposed Development from localised areas of the east and west mountain ranges of the WLA that could result in changes to the perceptual response of a *sense of sanctuary and solitude*. The Proposed Development is likely to have little or no influence on other perceptual responses associated with this attribute and as such they have not been considered further.
A landscape which is well-defined, whose rugged qualities are widely experienced from the surrounding areas	Not included in assessment The location of the Proposed Development towards the west of Kintyre results in few locations where the proposed turbines would be seen within views towards Arran and the WLA. From the very limited locations where this could potentially occur the Proposed Development would be a small background feature which would not influence the appreciation of this attribute.
A strong sense of naturalness, with unmodified catchment systems and little intensive land use within the wild land area	Not included in the assessment. It is judged that the Proposed Development would not affect an appreciation of this attribute.

[2] Key attributes as defined in the North Arran (03) Wild Land Area description published by NatureScot

3.1.6 NatureScot (2020) guidance states (p.4, para.15) that *"the study area should reflect the extent of likely significant effects on the WLA(s), rather than necessarily seeking to cover the entire WLA"*.

3.1.7 The ZTV (Figure A7.4.1, EIAR Volume 2c) shows that the pattern of theoretical visibility of the Proposed Development is limited to two distinct geographic regions of the North Arran WLA, the rounded western hills and summits of Beinn Bharrain, Meall nan Damh, Sail Chalmadale, Beinn Bhiorach, and Meall Mor, and the upper west-facing slopes of Glen Lorsa and summits of the rugged eastern granitic peaks of Beinn Tarsuinn, Caisteal Abhail and Goatfell to the east. The assessment focuses on these two geographic areas but also considers potential change on the WLA as a whole.

3.1.8 Key routes within the WLA have also been considered as part of this assessment and are identified in Table 2 and shown on Figure A7.4.1 (EIAR Volume 2c).

Table 2 Routes considered within the assessment

Route Reference	Length	Description of the route and theoretical visibility
Core Path AR76 Goatfell	5.4km	This route is the Goatfell tourist route. The SNH (2017) Descriptions of Wild Land Area – North Arran (03) notes that this summit is popular with walkers and climbers. Approximately half of this route falls within the WLA. Within the WLA only the very western extent of this Core Path, around the summit of Goatfell, falls within the ZTV of the Proposed Development.
Core Path AR81 Coirein Lochan	2.5km	This route joins Thundergay to Coirein Lochan. The SNH (2017) Descriptions of Wild Land Area – North Arran (03) notes that the hills to the west [of the WLA] are less accessible and more rounded than those to the east. They tend to be less popular with walkers or climbers seeking the challenge of the eastern mountains. Approximately two-thirds of this route falls within the WLA. Within the WLA, the majority of the route falls within the ZTV of the Proposed Development.

3.1 Cumulative Effects

3.1.1 In addition to potential effects resulting from the Proposed Development on the existing baseline, it is also important to consider effects of the Proposed Development in addition to other consented and proposed wind farms.

3.1.2 As outlined in the LVIA methodology (Appendix 7.1, EIAR Volume 3), the assessment of cumulative landscape and visual effects is based on two cumulative baseline scenarios, as follows:

- **Scenario 1:** The cumulative baseline for this scenario includes wind farms which have been consented and/or are under construction in addition to existing operational schemes, and,
- **Scenario 2:** The cumulative baseline for this scenario includes schemes at application stage in addition to existing operational schemes and those which have been consented and/or are under construction.

3.1.3 Wind farms at the scoping or pre-application stage are not considered in the cumulative assessment due to the indicative nature of these schemes and the lack of certainty they will progress to the application stage. Cumulative schemes included in the assessment are listed in Table 7-6 of the LVIA (Chapter 7, EIAR Volume 2a).

4. Baseline

4.1.1 Table 3 provides a summary of the published baseline description of those attributes and qualities of the North Arran WLA included in the assessment.

Table 3 North Arran WLA summary of key attributes and qualities

Key Attribute	Summary of Published Description
A readily accessible area, but with strong wild land attributes, especially within the remote interior	• Although readily accessible, the sea crossing to Arran heightens the sense of remoteness, • Views out from the WLA reinforce separation from the mainland, • Parts of the interior of the WLA are comparatively distant from encircling roads, with few tracks penetrating into the area, • Some constructed walking paths are present leading to more popular hills, otherwise access is more difficult, • Enclosure of low-lying interior by mountains results in a strong sense of remoteness and sanctuary, • Coastal settlement and forestry on Arran, and movement and noise from boats and ferries reduces the sense of remoteness, sanctuary and solitude from outward facing slopes and summits, and • Buildings, wind farms and forestry on the mainland (including Kintyre) have less influence on wild land qualities due to their distance and small extent.
The contrast in experience between the rugged east and smoother and more remote west mountain ranges	• Sharp contrast between rugged mountains in the east, and more rounded moorland hills to the west, • Cluster of rugged mountain peaks and serrated ridges in the east, their height accentuated by the proximity to the sea, • Difficulty of terrain on the eastern mountains results in increase physical challenge and sense of remoteness and risk, • Proximity to Brodick make Goatfell and adjacent peaks very popular leading to erosion, litter and overcrowding which can reduce the sense of remoteness, and • Hills to the west less accessible and more rounded, and generally less popular with walkers leading to greater sense of remoteness and isolation.

4.2 Verification of the WLA Key Attributes and Qualities Included in the Assessment

4.2.1 The SNH 'Descriptions of Wild Land Areas – North Arran (03) Wild Land Area' was published in 2017, informed by site assessment carried out in August 2013.

4.2.2 Verification of the baseline of the WLA and its key attributes and qualities was undertaken through field work observation in June 2021. Table 4 identifies changes to the baseline relevant to each of the key attributes and qualities included in the assessment. A series of photographs are also provided to further aid the understanding of the current baseline conditions of aspects of the WLA.

Table 4 Description of change to the baseline

Description of Baseline Change	Influence on Key Attributes and Qualities
Additional wind farms have been constructed on Kintyre since the original baseline description of the WLA was produced. The most notable of these is Cour Wind Farm, located towards the eastern edge of Kintyre and as such a relatively prominent feature in views from the west of Arran (see Figures 1, 2 and 5, below). Freasdail Wind Farm is also a new addition to the baseline and increases the extent of the view towards Kintyre that is occupied by wind farms. Due to the enclosed nature of the low-lying interior of the WLA no notable change to the baseline was observed. Figures 3 and 4, below, show typical views of the WLA interior.	**A readily accessible area, but with strong wild land attributes, especially within the remote interior** The published description of this attribute identified that buildings, wind farms and forestry on the mainland (including Kintyre) have some influence on the wild land qualities, although this is tempered by their distance and small extent. The addition of Cour and Freasdail wind farms adds to the influence of external development (as indicated in Figures 5 and 6, below). However, there remains clear separation between development on Kintyre and the north of Arran such that these additional wind farms result in only a small reduction in the perceived wild land qualities. No change in the baseline of the interior area of the WLA was observed.
	The contrast in experience between the rugged east and smoother and more remote west mountain ranges As above, the new wind farms introduced into the baseline since the description of this attribute was published have a small influence on perceptual attributes. This is more noticeable from the outward facing slopes and summits in the west, with reduced influence on the eastern mountains due to increased distance.

Insert 1 View west from bealach south of Meall Bhig (extent of Cour wind farm indicated):

Insert 2 Cour wind farm seen from Core Fhionn Lochan from within the WLA

Insert 3 View east towards the WLA interior from bealach south of Meall Bhig

Insert 4 Remote interior of the WLA, experienced in the low-lying Glen Catacol

5. Assessment of Effects

5.1.1 The assessment focusses on likely significant effects during construction and operation of the Proposed Development upon the attributes and perceptual qualities identified in Table 2. One perceptual response, a sense of sanctuary and solitude, in relation to two of the defined attributes of the North Arran WLA has been identified for inclusion in the assessment. The remaining perceptual responses to these and other attributes have been scoped out of the assessment due to no potential for significant effects.

5.1 Assessment of Effects on the 'Sense of Sanctuary and Solitude' Perceptual Response

Sensitivity

5.1.1 The enclosed nature of the low-lying interior of the WLA, as shown in Insert 4, results in a strong sense of remoteness, sanctuary and solitude. This sense of remoteness extends to the inward facing slopes, as shown in Insert 3. However, from outward facing slopes and summits, scattered settlement, roads, commercial forestry, and electricity infrastructure along the narrow coastal margin of Arran influence the sense of remoteness and solitude. Built development, wind farms and commercial forestry on the mainland contributes to the reduction in the perception of remoteness, although this is moderated by the distance and clear separation of Arran from the mainland.

5.1.2 At night, light from settlement and roads along the coast of Arran and the more distant mainland and from fish farms, boats and beacons in the Firth of Clyde and Kilbrannan Sound are visible and contrast with the interior of the WLA where very few light sources are apparent. In general, perceptual attributes of the WLA are less apparent at night and are likely to be experienced by few people. However, where experienced, a lack of artificial light sources can reinforce the perceived sense of remoteness, isolation and solitude.

5.1.3 The presence of development along the coast of Arran and on the mainland, including at night, gives a context to outward views from parts of the WLA, reducing the susceptibility to other similar development external to the WLA.

5.1.4 On balance, taking into account the **High** value of the WLA, and a **Medium** susceptibility, the overall sensitivity is judged to be High, although this is reduced for this type of development when located on mainland Kintyre.

Magnitude of Effect

5.1.5 Potential change during construction would be of short duration. Construction activity would be distant (approximately 15 km) and screened from the majority of the WLA, including the interior where the greatest sense of sanctuary or solitude is present. Taking into account the existing context of development and activity along the near coast of Arran and more distant Kintyre peninsula and the physical separation provided by the Kilbrannan Sound, the Proposed Development would have very little influence on the overall sense of sanctuary and solitude experienced within the WLA. The magnitude of effect during construction would be **Very Low**.

5.1.6 During operation, the level of activity within the Development Site would be reduced, although the introduction of a cluster of turbines and associated movement has the potential to influence the perceptual response. As indicated by the ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) there would be no visibility of the Proposed Development from the majority of the WLA, including from the low-lying interior where wild land characteristics are at their strongest, and from the majority of recognised Core Paths. The limited nature of potential visibility from north Arran is in part a result of the site selection process, informed by RWE's viewshed analysis model. Visibility, and potential influence of the Proposed Development, is largely limited to the higher outward facing slopes and summits of the western hills, including parts of Core Path AR81 (as represented by

5.1.7 Insert , below) and Beinn Bharrain (Figures VP24.2 to VP24.4; EIAR Volume 2c) and the summits of the more distant eastern hills, including Beinn Tarsuinn (as represented by Insert 6 (below) and a short section of Core Path AR76 and Goatfell summit (Figure VP25.2, EIAR Volume 2c). In each location, and from the limited parts of the WLA where the Proposed Development would be visible, it would be seen in the context of a number of existing wind farms on Kintyre, some of which are closer to, more prominent, and already have an influence on the WLA, albeit minor.

5.1.8 The lighting ZTV (Figure 7.8; EIAR Volume 2c) indicates a similar, although slightly reduced pattern of visibility of the aviation lighting. Where visible, the proposed aviation lighting would be seen in the context of other existing light sources, including along the Arran and Kintyre coasts and within the Kilbrannan Sound. The Proposed Development would add further light sources into this context, at a distance of over 15 km and clearly external to and separated from the WLA. Night-time photomontages from Beinn Bharrain (Figures VP24.5 and VP24.6) are provided in EIAR Volume 2d. It is important to note that as a result of the distance from the turbines, in clear conditions when the lights are visible they would be operating on the lower intensity mode, as illustrated by Figure VP24.6. In times of lower visibility it is likely that the aviation lighting would be at least partially obscured by cloud or other atmospheric conditions. Furthermore, due to the challenging nature of the terrain there are unlikely to be people accessing those parts of the WLA with visibility of the aviation lighting at night, particularly in poor weather conditions.

5.1.9 Overall, considering the limited nature of the ZTVs, the distance from the WLA and the existing context of other more prominent wind farms, development and light sources in outward views, the Proposed Development would have a very limited influence on the sense of sanctuary and solitude experienced within the WLA. The magnitude of effect during operation would be **Very Low**.

Significance of Effect

5.1.10 The Proposed Development would be perceived from a limited part of the WLA where existing, more prominent, wind farms are already seen and would not have an influence on the low-lying remote interior. The published description of the WLA acknowledges the role that distance and separation have in reducing the influence of existing wind farm schemes on Kintyre. The Proposed Development would be appreciated in the same context and more distant than some of the existing schemes. Thus, for the perceptual response of 'a *sense of sanctuary and solitude'* the significance of effect during construction and operation is judged to be **Negligible (not significant)**.

Cumulative Effects

Scenario 1:

5.1.11 The majority of the identified cumulative schemes would be visible from parts of the WLA, and particularly west facing slopes and hill summits, as indicated by the Cumulative ZTV (Figure 7.13, EIAR Volume 2c). From these locations the Beinn an Tuirc I-III, Blary Hill, Auchadaduie and Tangy IV arrays are often viewed together and are likely to be perceived by most as one large, extensive wind farm to the south of Kintyre (as indicated on Insert 6, below). The Deucheran Hill cluster generally stands alone in the central part of the peninsula, with High Constellation and Cour forming a large group further north towards the east of Kintyre (as indicated on Inserts 5 and 6, below). Further north, the Freasdail and Eascairt schemes would appear as an additional large group, with separation to the more distant Airigh scheme that would also be seen in this part of the view (Insert 5 and 6, below). A number of other wind farms are also apparent to the north on the Cowal peninsula and in the distance to the east on mainland Ayrshire.

5.1.12 As with the cumulative schemes, the Proposed Development would be located outwith the WLA and within the upland interior of mainland Kintyre. As demonstrated by the cumulative ZTV (Figure 7.13, EIAR Volume 2c), the Proposed Development would be visible from a smaller extent of the WLA than those schemes within the cumulative baseline and would not result in any additional areas from which wind farms would be visible. Several of the cumulative schemes, and most notably Cour, High Constellation and Eascairt, would be relatively prominent within outward views from parts of the WLA, particularly in the west (see Insert 5, below). The Proposed Development would appear as a distinct and more distant cluster, adding to the existing context of wind development external to the WLA.

5.1.13 As a result of this existing context of wind development on Kintyre and the intervening distance, the Proposed Development would result in little, if any, additional change to the sense of solitude and sanctuary apparent within the WLA. The magnitude of cumulative change is judged to be **Very Low** and the significance of effect in relation to this scenario, **Negligible (not significant)**.

Scenario 2:

5.1.14 This scenario sees the addition of the Narachan and Sheirdrim wind farms to the cumulative baseline, both located on Kintyre. Where visible, the Narachan scheme would become a relatively prominent feature within outward views, particularly from the west of the WLA, where it would appear to enlarge the group formed by Cour and High Constellation (as indicated in Insert 5, below). Aviation lights on each of the Narachan turbines would also be visible adding to the existing context of lights along the coast and within Kilbrannan Sound. From many locations Sheirdrim would appear to fill the gap between the Eascairt and Freasdail schemes (see Inserts 5 and 6, below). The addition of these schemes slightly increases the extent of the WLA from which wind farms on Kintyre are visible adding to the context of wind farms on Kintyre which have some influence on the perception of sanctuary and seclusion within parts of the WLA, although tempered by the clear separation provided by the Kilbrannan Sound.

5.1.15 Similar to Scenario 1, the Proposed Development would be visible from a smaller extent of the WLA than the cumulative schemes and would not result in any additional areas of visibility. It would add

to the existing context of wind farms on Kintyre and increase the number of aviation lights visible from localised areas, although at a greater distance and less prominent than other schemes (see Inserts 5 and 6, below). As with Scenario 1, the magnitude of cumulative change on the perception of sanctuary and solitude within the WLA is judged to be **Very Low**, resulting in a **Negligible (not significant)** level of effect.

6. Judgement of Significance of Effect on the North Arran WLA

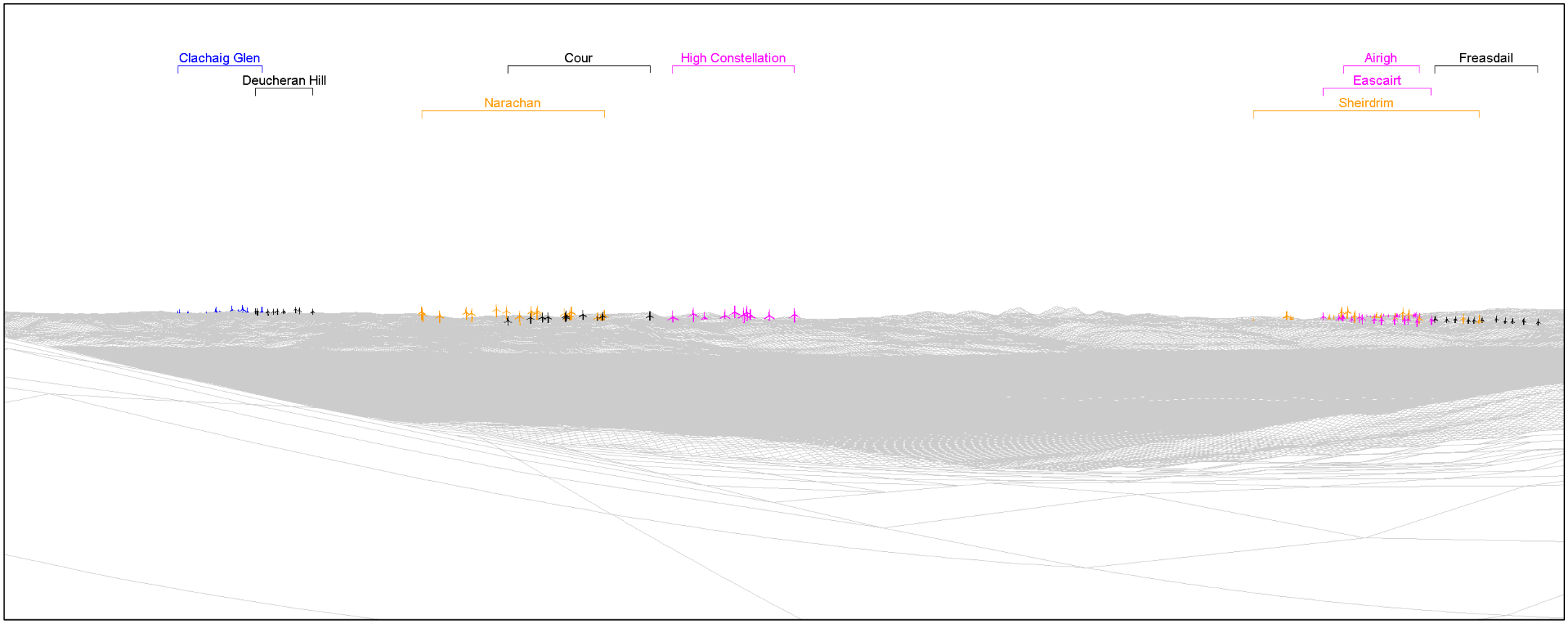
6.1.1 The Proposed Development is not located within any WLA boundary and as such there would be no effect on any of the identified physical attributes.

6.1.2 The assessment focused on one perceptual response, *a sense of sanctuary and solitude*, in relation to two of the attributes within the published WLA description: *A readily accessible area, but with strong wild land attributes, especially within the remote interior*, and *the contrast in experience between the rugged east and smoother and more remote west mountain ranges*. It was judged that there would be very little or no potential for change in relation to the other attributes and perceptual responses of the WLA.

6.1.3 The assessment found that there would be very little perceptible change to the sense of sanctuary and solitude experienced within the WLA as a result of the Proposed Development, including at night. Primarily, this is a result of the limited extent of the ZTV, the separating distance involved between the Proposed Development and WLA, and the existing influence that operational wind farms, other development and existing light sources on Kintyre and the Arran coast have on the WLA.

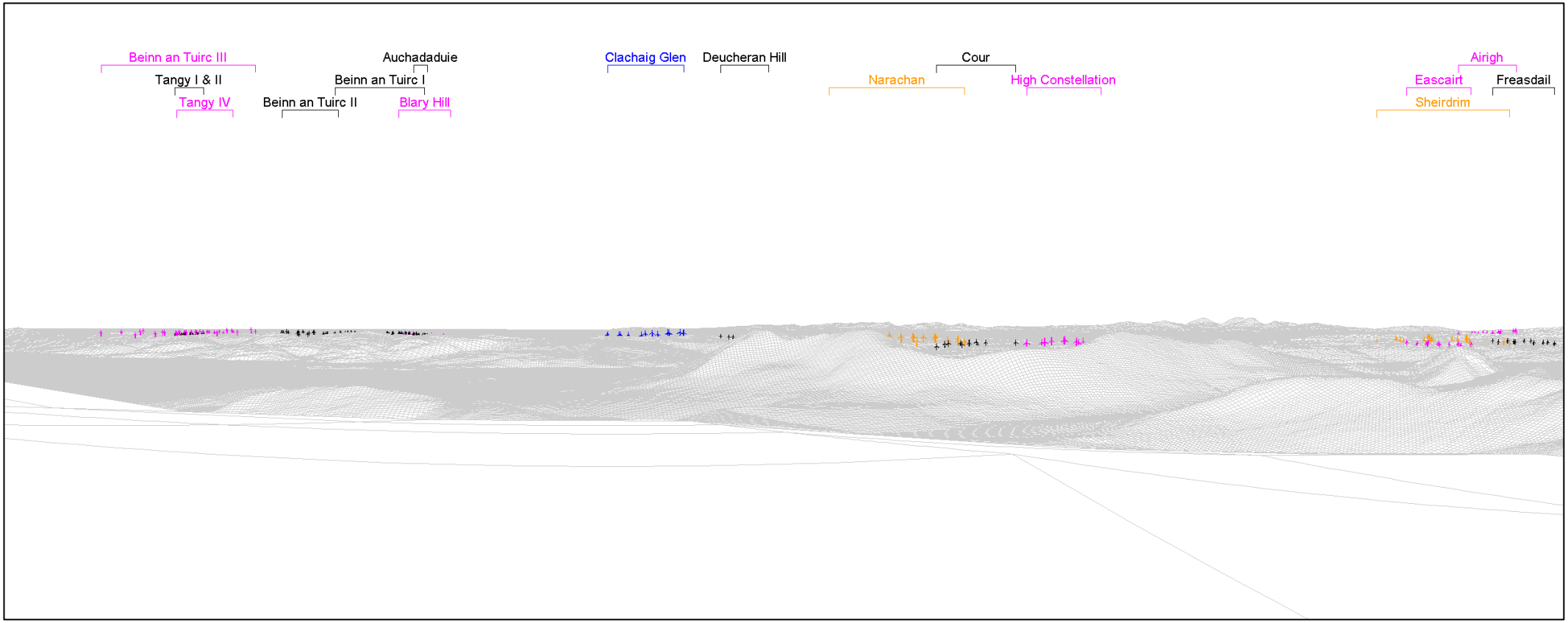
6.1.4 The overall significance of effect of the proposed Development on the North Arran WLA is judged to be **Negligible (not significant)**.

Insert 5: Wireline from Core Path AR81, west of Coire Fhionn Lochan



OS reference:	189830 E 646200 N
Eye Level:	317m AOD
Direction of View:	290°
Horizontal Field of View:	90° (cylindrical projection)

Insert 6: Wireline from Beinn Tarsuinn summit



OS reference:	195970 E 641270 N
Eye Level:	828m AOD
Direction of View:	280°
Horizontal Field of View:	90° (cylindrical projection)

RWE

Clachaig Glen Wind Farm

Environmental Impact Assessment Report

Volume 3

Technical Appendices

Appendix 7.5: Landscape and Visual Assessment Tables

Appendix 7.5 Landscape and Visual Assessment Tables

1. Introduction

1.1.1 The following tables provide a detailed assessment of potential effects on each of the identified landscape and visual receptors. These should be read in conjunction with Chapter 7: Landscape and Visual (EIAR Volume 2a), Appendices 7.1 to 7.4 (EIAR Volume 3) and the Figures provided in EIAR Volumes 2c and 2d.

1.2 Landscape Designation

1.2.1 The detailed assessment of potential effects on the special landscape qualities of the North Arran National Scenic Area (NSA) is provided in Appendix 7.3 (EIAR Volume 3) and on the attributes of the North Arran Wild Land Area (WLA) is provided in Appendix 7.4 (EIAR Volume 3). Table 1 to Table 3 provide an assessment of effects on the local level designations found within the study area.

Table 1 Effects on West Kintyre Area of Panoramic Quality (APQ)

Receptor: West Kintyre APQ

Baseline Description

No descriptions of the APQ or the defining characteristics are provided within the Argyll and Bute Local Development Plan (LDP). However, this was examined as part of the public inquiry for the Consented Scheme and the reporters concluded the following in their inquiry report[1]:

> *'…the West Kintyre Area of Panoramic Quality is a landscape designation based on the scenic quality of the designated landscape and what can be viewed from it, in particular out to the islands in the west. The designation does not follow landscape character type boundaries but has a clear relationship with the coast and scenic views out over Gigha and towards Islay and Jura. We conclude that it is impacts on what can be seen from within the designation and the impact on the landscape of the designation itself that should be our key concerns.'*

This APQ follows the thin coastal strip from Kilchenzie in the south to Portachoillan in the north. This is a well settled, low lying coastal landscape which includes sections of raised beach. Land use is mixed but predominantly agricultural and land cover is a mix of arable, rough, and improved pasture, scrub, and woodland. This landscape has a strong connection to the sea and the main focus is the panoramic vistas across the Sound of Gigha and towards the distant islands of Islay and Jura. The steeply rising inland hills create a distinct visual separation between the raised upland and the coastal plain, that also serves to reinforce the panoramic, seaward-focused qualities of the APQ. Several operational wind farms are visible from the APQ. Freasdail Wind Farm has a strong local influence on a small area at Dun Skeig, locally reducing the sensitivity, with turbines on Gigha a visible component of views west from this landscape.

The value of APQs, on account of their local importance, is judged to be **Medium**.

[1] Planning and Environment Appeals Division (2019). Report to Scottish Ministers, Case reference PPA-130-2064.

Receptor: West Kintyre APQ

Landscape Sensitivity

No wind farms are located within the West Kintyre APQ. However, operational wind farms influence parts of this designated area, to varying degrees. Taking into account the small-scale nature of this landscape, it is considered to have a **High** susceptibility to change. Together with the Medium value of this locally designated landscape, the sensitivity is assessed as **Medium**.

Magnitude of Effect - Construction

Changes during construction would be of short duration, and reversible. The access track of the Proposed Development would be partly located within the APQ; therefore, change would be both direct and indirect. Upgrades to the proposed access junction with the A83 would directly affect a very small geographic extent of the designated landscape. Following construction, the area affected would be reinstated and replanted, minimising potential change in the long-term. Construction activity within the inland Upland Forest Moor Mosaic Landscape Character Type (LCT) would be screened by intervening topography and vegetation. Indirect change on this landscape would arise from upgrading works to a short section of access track. The geographic extent of change of both direct and indirect effects would be to a very small part of this APQ.

Overall, the magnitude of effect during construction is judged to be **Very Low**.

Magnitude of Effect – Operation

Operational effects would be of long duration. The Blade Tip Zone of Theoretical Visibility (ZTV) (Figure 7.6, EIAR Volume 2c) shows areas of theoretical visibility largely limited to within up to 8 km in the north and up to 6 km in the south of the APQ, with only very localised and limited visibility beyond this, including at Dun Skeig (approximately 14.5 km north) and the coastal margin south of Bellochantuy (approximately 10.5 km south). The main areas of theoretical visibility of the proposed turbines are focused to the west of the A83 around Rhunahaorine Point and Glenacardoch Point, with the majority of the APQ (over 65%) experiencing no visibility. From the areas of the APQ with theoretical visibility of the Proposed Development, this would generally be limited to the tops of a small number of turbines. The Hub Height ZTV (Figure 7.7, EIAR Volume 2c) indicates very limited visibility from the APQ, focused at Rhunahaorine and Glenacardoch and extending to less than 14% of the total area. In reality this is likely to be further reduced as a result of localised screening from forestry.

The Proposed Development would be located inland to the east and clearly separated from the APQ by an upland ridge, appearing distinctly within the upland interior of the Kintyre peninsula. Existing wind farms are a feature of inland views from parts of the APQ, including the Glenacardoch area, Rhunahaorine and Dun Skeig, and in views west towards Gigha. The Proposed Development would not have an influence on the important views west from the APQ, or on the strong connection with the sea.

The scale of change arising from the Proposed Development would be small and not uncharacteristic in the context of other operational wind farms visible from the APQ. No views to the west from the APQ would be impacted. It would not therefore affect the strong and key focus towards the seascape to the west.

Overall, the magnitude of effect during operation is judged to be **Low**.

Significance of Effect

During construction, the significance of effect is judged to be **Negligible (not significant)**. During operation, the significance of effect on the West Kintyre APQ would be **Minor (not significant)**.

Table 2 Effects on Knapdale / Melfort APQ

Receptor: Knapdale / Melfort APQ

Baseline Description

No descriptions of the APQ or the defining characteristics are provided within the LDP.

This APQ covers the south west tip of Knapdale. This area covers the varied mosaic landscape of this part of Knapdale, on the western slopes falling away to Loch Caolisport and the Sound of Jura.. The important views from this area are the panoramic vistas across the seascape to the south, taking in Gigha, Islay, Jura, and the distant Kintyre peninsula.

The value of APQs, on account of their local importance, is judged to be **Medium**.

Landscape Sensitivity

The landscape characteristics described above contribute to a judgement that this APQ has a **High** susceptibility to the type of change proposed. The overall sensitivity to the Proposed Development is assessed as **Medium**.

Magnitude of Effect - Construction

Potential change to the APQ would be indirect. ZTV coverage is limited to the coastal fringe and elevated upland ridges. At its closest point, construction activity would be seen over distances in excess of c15 km and is judged to result in a **Very Low** magnitude of effect on landscape character.

Magnitude of Effect – Operation

Operational effects would be of long duration. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) show limited and heavily fragmented theoretical visibility. In reality woodland and forestry cover would further reduce the extent of visibility of the Proposed Development from this APQ. Where visible, the Proposed Development would appear as a distant feature within the interior of Kintyre. A number of existing wind farms are present on the Kintyre peninsula, and the Proposed Development would add an additional distant cluster of turbines into views from localised parts of this APQ. While there would be a perceptible change to the panoramic seaward views, the scale of change would be small and would not diminish the impression of vast seascape and presence of the islands of Gigha, Jura and Islay.

Overall, the magnitude of effect on the qualities of the APQ would be **Very Low**.

Significance of Effect

During construction and operation, the significance of the effect on the qualities of the Knapdale / Melfort APQ would be **Negligible (not significant)**.

Table 3 Effects on North Arran Special Landscape Area (SLA)

Receptor: North Arran SLA

Baseline Description

No descriptions of the SLAs or their defining characteristics are provided within the North Ayrshire Council (NAC) Adopted Local Development Plan.

This SLA boundary includes a variety of landscapes on Arran. Reference should be made to the baseline descriptions for the Arran Raised Beach Coast LCT (Table 9 below), Coastal Lowland Moor LCT (Table 10, below) and Arran Rugged Granite Uplands LCT (Table 11, below). The SLA overlaps with parts of the North Arran NSA and WLA.

Operational wind farms on Kintyre are perceived to varying degrees from parts of the SLA. From low-lying west-coastal locations and western hills on Arran (see Viewpoints 22, 23, and 24, EIAR Volume 2d) several wind farms are seen along the moorland interior of Kintyre. Some of these wind farms are also visible from more distant elevated slopes and summits of the eastern part of the SLA (see Viewpoint 25, EIAR Volume 2d).

The value of the landscape within the SLA, much of which is also within an NSA, is judged to be **High**.

Landscape Sensitivity

Taking into consideration the characteristics and context of the SLA it is considered to have a **Medium** susceptibility to change to wind farms outside of its boundaries. Together with the High value of this landscape, the sensitivity is assessed as **High**.

Magnitude of Effect - Construction

Potential change to the SLA would be indirect. Construction activity within the Upland Forest Moor Mosaic LCT on Kintyre would be distant (a minimum of c.14 km), and in part screened by intervening moorland landform and commercial forestry. The intervening distance and perception of separation between Arran and the mainland would further reduce the influence of construction activities on the SLA. The geographic extent of change would be limited to elevated parts of the SLA with views into the moorland interior of Kintyre, where it would be appreciated as part of an expansive surrounding landscape.

The magnitude of effect during construction is judged to be **Very Low**.

Significance of Effect

The significance of effect of the Proposed Development on the North Arran SLA during construction and operation would be **Negligible (not significant)**.

1.3 Landscape Character Types and Seascape Units

Table 4 Effects on Upland Forest Moor Mosaic LCT

Receptor: Upland Forest Moor Mosaic LCT (ABLWECS (2017) LCT 6)

Baseline Description

The interior of the Kintyre uplands forms an extensive, fairly homogenous undulating plateau with occasional hills. This LCT forms the backdrop of extensively forested hills and moorland to the more richly patterned and low-lying coastal fringes. Land cover comprises a large-scale mosaic of extensive coniferous forestry and open moorland with some blanket bog. This is a sparsely settled landscape, with isolated farms and houses located on lower hill slopes, and generally little evidence of domestic-scale development. This landscape is difficult to access, and although a sense of seclusion can be experienced in many areas, the perception of naturalness is reduced by the presence of extensive commercial forestry, several operational wind farm developments and power lines between Carradale and Crossaig, and Crossaig and Inveraray, the latter of which is currently undergoing an upgrade / replacement. No landscape designations apply to this LCT, although it abuts the APQ designated areas on the west and east coasts of the Kintyre peninsula (Figure 7.4b and 7.5b, EIAR Volume 2c).

The published descriptions of this LCT do not refer to any specific dark sky characteristics. There are no existing medium intensity visible aviation lights on existing wind turbines or other structures within this LCT, although lower intensity (32 candela) aviation lighting is present on the Auchadaduie and Tangy schemes. As described above, this is a sparsely settled landscape, containing few vehicular routes, and as such sources of artificial light are limited. In certain locations light sources from the surrounding more settled lowland and coastal landscapes are visible and have a localised influence.

Overall, the Upland Forest Moor Mosaic LCT is judged to have **Medium** landscape value.

Landscape Sensitivity

On balance, this medium to large scale landscape, which includes a number of existing operational wind farms to the north and south, contributes to a **Low** susceptibility to change. The overall landscape sensitivity of this LCT is judged to be **Medium**.

Receptor: Upland Forest Moor Mosaic LCT (ABLWECS (2017) LCT 6)

Magnitude of Effect - Construction

The Proposed Development would be located within this LCT and would therefore result in both direct (physical) and indirect change. A description of the physical effects within the Development Site boundary is provided in Chapter 7 (EIAR Volume 2a).

There would be a noticeable, but short-duration indirect change to the immediate surroundings of the Development Site as a result of the increased movement and activity and the addition of temporary features such construction compounds and borrow pits, and to a lesser extent the removal of areas of commercial forestry.

The scale of change during construction is judged to be small as a result of the LCT being characterised partly by large-scale commercial forestry operations and having a context of several existing wind farm developments. The geographic extent of change (i.e. characterising effects) would be very contained, generally perceived from areas of open ground up to c.2 km from the Development Site and would diminish quickly with distance amid the undulating topography, and large areas of commercial forestry. Effects would theoretically be reversible.

It is judged that the magnitude of effect on the landscape character of this LCT during construction would be **locally Medium** up to 2 km, and **Low** for the LCT as a whole.

Receptor: Upland Forest Moor Mosaic LCT (ABLWECS (2017) LCT 6)

Magnitude of Effect – Operation

The Proposed Development would create a long duration change during operation. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) show a heavily fragmented pattern of visibility. Areas of continuous theoretical visibility are concentrated to the Development Site area and immediate surroundings, within approximately 3 km to the north and south-west, although in reality this would be restricted locally by commercial forestry. A further band of visibility extends across the southern side of Teanchoisin Glen and Barr Glen. The pattern of visibility decreases substantially with distance amid the undulating topography. Further south, there are small areas of theoretical visibility from north-facing slopes of hill tops including Meall Buidhe (8 km); Cnoc Buidhe; and Sgreadan Hill (12 km). To the north of this LCT, the patches of theoretical visibility are larger, but generally receptors would perceive fewer turbines, other than on the highest summits. In addition, many of the areas indicated as gaining theoretical visibility coincide with forestry plantations and as such the actual impression of change would be further reduced.

The lighting ZTV (Figure 7.8, EIAR Volume 2c) indicates a similar, although reduced, pattern of visibility of the aviation lighting to that of the wider Propose Development as the aviation lighting will be located at hub height and on only 8 of the 12 proposed turbines. The night-time baseline of this landscape is one with few existing light sources, and no existing medium intensity aviation lights. The introduction of lighting would therefore be a notable change but generally only to localised parts of this landscape, and given the relative inaccessibility of the area few people are likely to be in this landscape at night to experience the change. Furthermore, as indicated by the lighting intensity ZTV (Figure 7.9, EIAR Volume 2c), the intensity of the lighting at those parts in closest proximity to the Proposed Development would be considerably reduced due to the directional nature of the proposed light. From more distant location, beyond 5 km, when visible, the lighting is likely to be operating on the lower (10%) intensity mode. In addition, with distance and closer to the settled coastal landscapes to the east and west that contain other light sources the influence of the proposed aviation lighting would reduce.

Operational wind farms are an existing characteristic of this landscape, both to the north and south of the Proposed Development site, seen to varying degrees amid the undulating topography of the upland moorland. The wider perceived change would be appreciated as an incremental increase in the number of wind turbines within an LCT partly characterised by similar forms, and the introduction of aviation lighting into central parts of this LCT during hours of darkness.

There would be localised notable change from areas of open ground within up to approximately 2 km from the Development Site, resulting in a **locally Medium** magnitude of effect. The magnitude of effect beyond these localised areas and for the LCT as a whole would be **Low**.

Significance of Effect

During construction and operation there would be a **locally Moderate (significant)** effect on a small part of this LCT, in the immediate vicinity of the Proposed Development and areas of open ground up to approximately 2 km of the Development Site. Effects on the wider extent of this LCT during construction and operation would be **Minor (not significant)**.

Table 5 Effects on Knapdale Upland Forest Moor Mosaic LCT

Receptor: Knapdale Upland Forest Moor Mosaic LCT (ABLWECS (2017) LCT 6b)

Baseline Description

This LCT forms a backdrop of forested hills (within more open higher ridges and peaks) to the more richly patterned low-lying coastal fringes of the Rocky Mosaic LCT. Land cover consists of a large-scale mosaic of forestry and open moorland. Dense forestry extends down lower slopes to the coastal edge in places. The Knapdale uplands rise to over 500m in the north-east and there are few smaller landscape features, such as buildings, within the core of this area, which is very sparsely settled overall. The irregular landform characteristic of these uplands provides local containment and reduces scale. This landscape is difficult to access, and a sense of seclusion can be experienced from many areas. While extensive commercial forest cover and operational wind farm development within this LCT (Srondoire and Allt Dearg) diminishes the perception of naturalness in parts of the landscape to the north of the detailed study area, other areas that are more visually contained and unaffected by development can appear natural. Public access within the LCT is limited and roads and settlement tend to be well contained.

Parts of this LCT within the detailed study area lie within the Knapdale / Melfort APQ (Figures 7.4b and 7.5b, EIAR Volume 2c); the qualities of the APQ are likely to include sweeping seascape panoramas to the south, and views towards the Southern Hebridean islands of Islay and Jura to the west. To the north of the APQ is the Knapdale NSA.

Overall, this LCT is judged to have **High** value.

Landscape Sensitivity

The landscape characteristics described above, including the influence of several operational wind farms, contribute to a judgement that this LCT has **Medium** susceptibility to the type of change proposed. The overall sensitivity to the Proposed Development is assessed as **Medium**.

Magnitude of Effect - Construction

Potential change to this LCT would be indirect. ZTV coverage is largely limited to elevated upland ridges that run through this LCT. At its closest point, construction activity would be seen over distances in excess of c18 km and is judged to result in a **Very Low** magnitude of effect on landscape character.

Magnitude of Effect – Operation

Within the detailed study area there would be a pattern of fragmented theoretical visibility, primarily from upland areas that are within forestry. Theoretical visibility becomes increasingly scattered with distance to the north of the LCT. The Proposed Development would be a small and distant feature in views towards Kintyre, which are already characterised by distant operational wind farms. The Proposed Development would have an aesthetic relationship with other wind energy schemes in a distant LCT. It would introduce additional vertical moving features to the distant skyline, but this would have limited influence on the perceptual qualities and appreciation of a dramatic seascape to the south of this landscape.

The Proposed Development would create a long duration of change during operation. Changes would be distant at c.18 km, and as shown by the ZTV would affect a limited geographic extent of this LCT. Within these areas, taking into consideration the existing influence of operational wind farms on Kintyre, the Proposed Development would result in a **Very Low** magnitude of effect.

Receptor: **Knapdale Upland Forest Moor Mosaic LCT** (ABLWECS (2017) LCT 6b)

Significance of Effect

The significance of effect of the Proposed Development on the Knapdale Upland Forest Moor Mosaic LCT during construction and operation would be **Negligible (not significant)**.

Table 6 Effects on Coastal Plain LCT

Receptor: **Coastal Plain LCT** (ABLWECS (2017) LCT 19)

Baseline Description

This landscape forms a flat and narrow strip of land on the west coast of Kintyre and as such has a strong connection to the sea, emphasised by the scenic panoramic views west across the sea to Gigha, Islay and Jura. It is backed by the low but pronounced scarp edge and hill slopes of the adjacent Rocky Mosaic LCT and the higher ground of the Upland Forest Moor Mosaic LCT to the east. The Coastal Plains LCT has an open and exposed character heightened by the presence of the sea. Large fields, coniferous plantations and shelterbelts are notable features. The small settlement of Tayinloan is located in this character type. Farms tend to be sited on higher ground to the east with a caravan park, jetty and ferry facilities located on the coast. A few larger sheds and the wind turbines on Gigha are conspicuous in views from this open landscape. An access track leading to the operational Deucheran Hill wind farm lies adjacent to this LCT on the A83. This landscape is managed and while the coastal edge has some naturalistic qualities, the proximity of settlement and the A83 limit a feeling of seclusion. This LCT falls within the West Kintyre APQ.

Overall, the value of this LCT is judged to be **Medium**.

Landscape Sensitivity

Taking into account the small-scale nature of this landscape it is considered to have a **High** susceptibility to change. Overall, the sensitivity of the landscape is judged as **Medium**.

Magnitude of Effect - Construction

Changes during construction would be of short duration and reversible. A small section of the access track falls within this LCT, causing direct change. Physical change to this LCT would be limited to the removal of short sections of hedgerow and the formation of a temporary laydown area to the west of the A83. Indirect change on this landscape would arise from the influence of works to a short section of access track and vegetation removal in the adjacent Rocky Mosaic LCT. The geographic extent of change of both direct and indirect effects would be to a small part of this LCT.

Overall, the magnitude of effect during construction is judged to be **Low**.

Receptor: **Coastal Plain LCT** (ABLWECS (2017) LCT 19)

Magnitude of Effect – Operation

Operational effects would be of long duration. A small part of the access track upgrades adjacent to the A83 would be within this LCT, resulting in limited and localised direct change. Following completion of construction, the temporary laydown area adjacent to the A83 would be removed and reinstated and the hedgerow replanted , reducing direct change in the longer term. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) show theoretical visibility to the west of the A83 from Killean northwards, including land east of Rhunahaorine Point. This would largely be limited to tops of turbines, although a small number of turbine hubs would be seen from the Rhunahaorine area. The proposed turbines would introduce further vertical moving features into an adjacent landscape, beyond the inland upland ridge. There is a clear separation and distinction between this settled coastal landscape and the upland interior of the peninsula within which all of the Proposed Development (other than a small section of access track) would be located, and which limits the impression of change on the Coastal Plains LCT. Taking into consideration the screening effect of topography which limits the ZTV, and the localised nature of direct change, the overall scale of change would be small.

The magnitude of effect during operation is judged to be **Low**.

Significance of Effect

The significance of effect of the Proposed Development on the Coastal Plain LCT during construction and operation would be **Minor (not significant)**.

Table 7 Effects on Rocky Mosaic LCT

Receptor: **Rocky Mosaic LCT** (ABLWECS (2017) LCT 20)

Baseline Description

This landscape forms a series of narrow, linear bands against loch or coast across the study area. It is of low relief rising to circa 180m. The irregular coastal edge, small knolls and often rolling landform provide strong containment. The presence of small woodlands, fields and settlement reinforces the small scale of this landscape type. However, it is noted that scale increases in parts of this landscape where a more gradual transition occurs with the adjacent Upland Forest Moor Mosaic LCT, where the landform and vegetation pattern is more even and simple. This landscape has small settlements, scattered properties, and occasional larger settlements such as Campbeltown and Tarbert. Access tracks leading to the operational Deucheran Hill, Cour, Beinn an Tuirc and Freasdail wind farms pass through this LCT at various locations along the western half of Kintyre. The loch shores and coastal fringes of this LCT make an important contribution to the wider scenic context, forming an intricately patterned band between the foreground of sea or loch and backed by simple and more expansive upland landscapes. A sense of seclusion can be experienced away from less settled and frequented areas, for example the east coast of Kintyre. Parts of this LCT fall within both the west / east Kintyre and Knapdale / Melfort APQs.

The landscape value is judged to be **Medium**.

Receptor: Rocky Mosaic LCT (ABLWECS (2017) LCT 20)

Landscape Sensitivity

A small-scale single turbine is located on the fringe of this LCT, but no larger scale wind farms are present. However, a number of wind farms are visible, to varying degrees, from this landscape type on the Kintyre peninsula and in particular from the western coast. The Tangy I and II and Auchadaduie schemes are locally prominent. Taking into account the small-scale nature of this landscape, it is considered to have a **High** susceptibility to change. Overall, the sensitivity is judged to be **Medium**.

Magnitude of Effect - Construction

Changes during construction would be of short duration. The access track of the Proposed Development would be partially located within this LCT and therefore potential change would be both direct and indirect. Direct effects would include temporary earthworks and vegetation clearance to facilitate access track upgrades. Indirect effects such as the influence of traffic and construction activity within the adjacent LCTs would be localised and have little influence on the character of this LCT. Overall, the magnitude of effect during construction is judged to be **Low**.

Magnitude of Effect – Operation

Operational effects would be of long duration. Trees and vegetation removed to facilitate access would be reinstated as far as possible, reducing potential direct change. The ZTVs (Figure 7.6 and 7.7, EIAR Volume 2c) shows very limited theoretical visibility of the Proposed Development across this LCT. Visibility of the proposed turbines would occur in limited locations on the west Kintyre coast including at the western extent of the Clachaig Water and Glenacardoch, and across the slightly elevated summit of Dun Skeig to the north. There is a clear distinction between this LCT and the upland landscape within which the Proposed Development would be located, emphasised in many locations by physical separation provided by an upland ridgeline. The ZTV also indicates potential localised visibility from parts of this LCT on the Knapdale peninsula. However, given the distance of over 15 km there would be little if any impression of change to the character of this area.

The characteristics of this LCT include its importance as contrast to the adjacent upland landscapes of the Kintyre and Knapdale interior when viewed from surrounding landscapes and seascapes. Taking into consideration the established influence that several operational wind farms located in the adjacent Upland Forest Moor Mosaic LCT have on this characteristic, the scale of change arising from the introduction of the Proposed Development would be limited. The geographic extent of change would be small. As a result of the limited nature of direct and indirect change, the magnitude of effect is judged to be **Low**.

Significance of Effect

The significance of effect of the Proposed Development on the Rocky Mosaic LCT would be **Minor (not significant)** during both construction and operation.

Table 8 Effects on Coastal Parallel Ridges LCT

Receptor: **Coastal Parallel Ridges LCT** (ABLWECS (2017) LCT 22)

Baseline Description

Within the detailed study area this LCT characterises the landscape of the Isle of Gigha. The landscape is fragmented by rocky outcrops and low ridges which, together with numerous woodlands and frequent trees, reduce the scale and provide enclosure. This landscape is partially settled, mainly along or close to the coast, with scattered houses and farms, and small settlements associated with sheltered bays. Inaccessible sections of coast can be experienced as secluded, even remote, and as a place where naturalness is a key characteristic. Elsewhere, this landscape is farmed with scattered settlement. Roads extend part way along the coast and then convert to narrow, dead end roads which continue along the less well settled parts of the coastline. The Gigha and Leim Farm wind turbines are situated within this LCT. Within the detailed study area this LCT is not covered by any landscape designation.

The value of the landscape is judged to be **Medium**.

Landscape Sensitivity

On balance, the medium to small scale, partially settled landscape characteristics, which include a context of existing wind energy schemes, result in a **Medium** susceptibility to change. The overall landscape sensitivity of this LCT is judged to be **Medium**.

Magnitude of Effect - Construction

Changes during construction would be of short duration, and reversible. The Proposed Development would be located outwith this LCT and therefore change would be indirect. Indirect effects such as the influence of traffic, removal of vegetation and formation of the access track within the Coastal Plan and Rocky Mosaic LCTs would be seen over some 7 km. Construction activity within the Upland Forest Moor Mosaic LCT would be screened by intervening landform. Construction activity within mainland LCTs would be perceived over a limited geographic extent which would reduce with distance, also taking into consideration the separation of this LCT from the mainland the magnitude of effect during construction is judged to be **Very Low**.

Magnitude of Effect – Operation

Operational effects would be of long duration. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicate that theoretical visibility, within this LCT, would be more extensive to the east of Gigha, becoming heavily fragmented moving to the west of the island. In reality trees and woodland, particularly south of Ardminish would further restrict visibility. From eastern parts of the LCT on Gigha the Proposed Development would increase the influence of wind energy development on the mainland. Nevertheless, the presence of existing wind turbines on Gigha, and other operational wind farms visible across Kintyre reduces the scale of change on the characteristics and qualities of this LCT. This is further reinforced by a clear separation of this LCT from the mainland landscape, and particularly its upland interior. The fragmented visibility, and separation distances involved, would also serve to reduce the magnitude of change of the Proposed Development which is judged to be **Low**.

Significance of Effect

The significance of effect of the Proposed Development on the Coastal Parallel Ridges LCT during construction would be **Negligible (not significant)**. During operation, the significance of effect is judged to be **Minor (not significant)**.

Table 9 Effects on Arran Raised Beach Coast LCT

Receptor: Arran Raised Beach Coast LCT (NALWCS (2018) LCT 1b)

Baseline Description

This landscape forms a narrow coastal margin which is contained by the cliffs of raised beaches. This character type lies adjacent to the dramatic high peaks of Arran. Although the sea gives a sense of expansiveness, the enclosure created by the raised beach cliffs on the western coast and very steep hill slopes on the east, creates a small scale, contained landscape. The presence of small farms and other buildings, woodlands, trees, and occasional enclosed fields further reduces scale. A degree of seclusion and naturalness is particularly associated with the less settled western coast, although locally reduced by the presence of settlement and the coastal road. In a wider context, Arran is perceived as being little developed in contrast with surrounding mainland landscapes which accommodate large scale industry and wind farm development. The LCT falls within the North Arran NSA.

The operational Cour Wind Farm is a prominent feature on the upper east facing slopes of upland Kintyre. Viewpoint 23 (EIAR Volume 2d) illustrates the influence of several wind energy developments including Beinn an Tuirc I and II, Freasdail and Deucheran Hill in views across the Kilbrannan Sound experienced from this LCT.

The value of the LCT is judged to be **High**.

Landscape Sensitivity

On balance, the small scale, relatively open landscape characteristics, together with the influence of existing wind energy schemes on Kintyre, result in a **Medium** susceptibility to change. Overall, the sensitivity of this landscape to the Proposed Development is judged to be **High**.

Magnitude of Effect - Construction

Construction activity would be focused within the Upland Forest Moor Mosaic LCT on Kintyre and would be screened from this LCT by intervening landform and vegetation on the mainland. Consequently, there would be **no change** on the character of this landscape during construction.

Magnitude of Effect – Operation

Operational effects would be of long duration. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicate that the geographic extent of visibility of the Proposed Development would be extensive across this LCT, although would generally be limited to the upper parts of a small number of turbines. From many locations the Proposed Development would be seen behind or immediately adjacent to the existing Deucheran Hill scheme such that it would appear as a minor extension. Having regard to the relationship the Proposed Development would share with operational wind farms outside of this LCT, the intervening distances of c.13 km, and separating influence of the seascape, the scale of change would be small.

Overall, this LCT would experience a **Very Low** magnitude of effect.

Significance of Effect

There would be **no effect** on this LCT during construction. The significance of effect of the Proposed Development on the Arran Raised Beach Coast LCT during operation would be **Negligible (not significant)**.

Table 10 Effects on Coastal lowland Moor LCT

Receptor: **Coastal Lowland Moor LCT** (NALWCS (2018) LCT 6)

Baseline Description

This LCT comprises a low-lying moorland basin which has an expansive and open character. Moorland is fringed by gently undulating hill slopes which are farmed and settled and the small coastal hill of Torr Righ Mor which provides containment to the west. A diverse and naturalistic vegetation cover is a key characteristic featuring extensive broadleaved scrub woodland, wetlands and moorland within the basin lying at the core of this landscape. Machrie Moor has strong cultural associations and, at its less modified core, a strong sense of naturalness and seclusion, and a distinct sense of place. The fringes of the moor are more modified by human activity, although not intensively farmed. Operational wind farms on Kintyre have some influence on views west across the seascape of the Kilbrannan Sound towards the mainland. This is likely to be increased with the construction of Beinn an Tuirc III. This landscape is settled on its fringes and popular with visitors to Arran because of its rich archaeological heritage. Parts of this LCT fall within the North Arran NSA.

The value of this landscape is judged to be **High**.

Landscape Sensitivity

Given the characteristics of the Coastal Lowland Moor LCT the susceptibility to change is judged to be **High**. The landscape sensitivity to the Proposed Development is assessed as **High**.

Magnitude of Effect - Construction

Construction activity would be focused within the Upland Forest Moor Mosaic LCT on Kintyre and would be screened from this LCT by intervening landform and vegetation on the mainland. Consequently, there would be **no change** on the character of this landscape during construction.

Magnitude of Effect – Operation

Operational effects would be of long duration. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicate that the geographic extent of visibility of the Proposed Development would be widespread within the small area of this LCT found within the 20km detailed study area, and more limited elsewhere. This would generally be restricted to upper parts (rotors and blades) of a small number of turbines. Having regard to the relationship the Proposed Development would share with operational wind farms outside of this LCT, the screening effect of topography, the intervening distances involved (over 18 km from the nearest turbine) and separating influence of the seascape, the scale of change would be very small. Overall, this LCT would experience a **Very Low** magnitude of effect.

Significance of Effect

There would be **no effect** on this LCT during construction. The significance of effect of the Proposed Development on the Coastal Lowland Moor LCT would be **Negligible (not significant)**.

Table 11 Effects on Arran Rugged Granite Uplands LCT

Receptor: Arran Rugged Granite Uplands LCT (NALWCS (2018) LCT 21b)

Baseline Description

The Rugged Granitic Uplands are a rare character type within Ayrshire. On Arran they include the major granite intrusion of the North Arran Mountains. The mountains form two groups; the dramatic eastern peaks, including Goat Fell, Caisteal Abhail and Beinn Tarsuinn, linked by a heavily serrated knife-edge ridge, and the more rounded western summits. The highly dissected landform forms high peaks and plunging 'U'-shaped valleys, such as Glen Lorsa, Glen Sannox and Glen Rosa. Woodlands are absent with the exception of coniferous plantations on lower slopes along the coastal fringes. The NALWCS asserts that these are amongst the most spectacular mountains in Scotland, providing a remarkable skyline when viewed from the mainland and Firth of Clyde. This landscape type sits within the designated North Arran NSA and defined WLA (assessed separately in Appendix 7.3 and 7.4, EIAR Volume 3).

The Tangy I and II, Beinn an Tuirc I and II, Auchadaduie, Deucheran Hill, Cour and Freasdail wind farms are visible in varying degrees from parts of this LCT as are wind farms on Cowal to the north and Ayrshire to the east.

This LCT underlies nationally important landscapes and is judged to have **High** value.

Landscape Sensitivity

The characteristics of the Arran Rugged Granite Uplands together with the influence of existing wind energy schemes on Kintyre, result in a **Medium** susceptibility to change. Overall, the landscape sensitivity to the Proposed Development is assessed as **High**.

Magnitude of Effect - Construction

Changes during construction would be of short duration, and reversible. The Proposed Development would be located outwith this LCT and as such change would be indirect. Construction activity within the Upland Forest Moor Mosaic LCT would be distant (a minimum of c.14 km), and in part screened by intervening moorland landform and commercial forestry on the peninsula. The intervening distance and perception of separation between Arran and the mainland would further reduce the influence of construction activities on this LCT. The geographic extent of change would be limited to elevated parts of this LCT with views into the moorland interior of Kintyre, where it would be appreciated as part of an expansive surrounding landscape.

The magnitude of effect during construction is judged to be **Very Low**.

Magnitude of Effect – Operation

Operational effects would be of long duration. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicate that the geographic extent of change would be limited to the western hills and in isolated patches within the high peaks and upper ridges to the east. Characteristics of this dramatic mountain landscape include extensive views in all directions and the Proposed Development would most often be appreciated within an expansive and varied landscape context, occupying a small part of the view. The Proposed Development would add further vertical moving elements to these views, seen in the context of existing, closer and more prominent, wind farms. There is clear separation between this LCT and the landscape within which the Proposed Development would be located, reducing the impression of change.

Given the relatively limited nature of the ZTV, the distance and existing context, this LCT is judged to experience a **Very Low** magnitude of effect during operation.

Receptor: Arran Rugged Granite Uplands LCT (NALWCS (2018) LCT 21b)

Significance of Effect

During construction and operation, the significance of effect on this LCT would be **Negligible (not significant)**.

Table 12 Effects on West Kintyre / South East Jura and South East Islay Seascape Character Unit (SCU)

Receptor: West Kintyre / South East Jura and South East Islay SCU (SNH (2005) SCU 24)

Baseline Description

Key characteristics of this SCU are described as a contained seascape created by the proximity of coasts of Jura, Islay and Kintyre forming a broad sound. Characteristics of the SCU include its even linear coastline, with no distinct headlands, yet occasional shallow sandy bays. There is a sheltered feel that becomes more exposed towards the open sea at Mull of Kintyre. Settlement is sparse, comprising farming and fishing communities, and there is no large-scale development. The Paps of Jura and headlands of Islay and Kintyre are key focal points from within this seascape; there are also far-reaching views to Ireland and Mull.

No wind farms are located within this seascape character unit. However, operational wind farms located on Kintyre are visible, to varying degrees, across a large geographic extent of the seascape. The published seascape character description identifies that turbines on Kintyre affect a perception of movement, and modification/remoteness/sense of naturalness within the seascape. Further wind farms have been constructed on Kintyre since this description was published, adding to their influence.

The seascape itself is undesignated, although many of the surrounding coastal landscapes on Kintyre, Knapdale, Jura and Islay are locally designated for their scenic qualities.

On balance, the value of the seascape is judged to be **Medium**.

Landscape Sensitivity

Taking into account the combination of the characteristics of this seascape and influence of existing wind energy schemes on Kintyre, it is judged to have a **Medium** susceptibility to change. Sensitivity is assessed as **Medium**.

Magnitude of Effect - Construction

Changes during construction would be of short duration. The Proposed Development would be located outwith this SCU, therefore change would be indirect. Indirect effects such as the influence of traffic and upgrading of the access track in the Coastal Plains and Rocky Mosaic LCTs have been assessed as having a small geographic extent on the mainland, thus would have limited influence on the wider seascape. Construction activity within the Upland Forest Moor Mosaic LCT would be screened by intervening landform.

Overall, the magnitude of effect during construction is judged to be **Very Low**.

Receptor: West Kintyre / South East Jura and South East Islay SCU (SNH (2005) SCU 24)

Magnitude of Effect – Operation

The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c). indicates a widespread geographic extent of change, becoming screened by landform only in close proximity to land, for example the west of Gigha and west Kintyre coastline.

Between 5 km and 10 km, within the Sound of Gigha, the Proposed Development would have indirect influence on this SCU as a notable onshore feature, seen in the context of a number of other existing wind farms. Thus, the proposed turbines would have a relationship with several existing landscape features experienced from within these parts of the SCU. In excess of 10 km, within the broad expanse of seascape to the west of Gigha, the influence of the Proposed Development would diminish with distance and in the context of further visible wind energy development. The introduction of further vertical moving features would not affect the inherent characteristics of this SCU. It would not detract from the foci and key views of this seascape which are noted towards the Paps of Jura.

Overall, this SCU is judged to experience a **Low** magnitude of effect.

Significance of Effect

During construction, the significance of effect is judged to be **Negligible (not significant)**. During operation, the significance of effect on this SCU would be **Minor (not significant)**.

Table 13 Effects on Loch Fyne / Kilbrannan Sound SCU

Receptor: Loch Fyne / Kilbrannan Sound SCU (SNH (2005) SCU 25)

Baseline Description

Key characteristics of this SCU are described as extremely narrow stretches of sea. Forestry is influential on the mainland. Some picturesque settlements can be found along coastlines, for example Inveraray. Other settlements that influence the seascape include Lochgilphead and Campbeltown. Views of the Arran Mountains are noted as dominating the Kilbrannan Sound. Roads typically follow the coastal edge. Viewpoint 21, EIAR Volume 2d is representative of views from within the SCU.

No wind farms are located within this seascape character unit. However, at various locations it is likely that several wind farms found on Kintyre would be visible from this waterbody.

Parts of this seascape fall within the North Arran NSA (see Figure 7.4b, EIAR Volume 2c)), while sections of the east Kintyre coast are locally designated as an APQ. On balance, the value of the seascape is judged to be **Medium.**

Landscape Sensitivity

Taking into account the combination of the characteristics of this seascape and influence of existing wind energy schemes on Kintyre, it is judged to have a **Medium** susceptibility to change. Sensitivity is assessed as **Medium**.

Magnitude of Effect - Construction

Construction activity would be focused within the Upland Forest Moor Mosaic LCT and would be screened by intervening landform and result in **no change** to the character of this seascape.

Receptor: Loch Fyne / Kilbrannan Sound SCU (SNH (2005) SCU 25)

Magnitude of Effect – Operation

The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicate that the geographic extent of visibility would be concentrated to the east of the Kilbrannan Sound. More extensive visibility is predicted to the west of Whitefarland Point northwards to Skipness. To the south of the Sound, the screening effect of landform on Kintyre is more pronounced resulting in more contained visibility experienced in close proximity to the west Arran coastline.

Operational wind farms visible from this narrow part of this SCU include parts of the Beinn an Tuirc, Deucheran Hill, Cour and Freasdail wind farms (see viewpoint 21, EIAR Volume 2d). Thus, the proposed turbines would have a relationship with a number of existing landscape features that influence views of Kintyre from this general location.

The introduction of further vertical moving features would not affect the inherent characteristics of this SCU. It would not detract from the foci and key views of this seascape which are noted to be towards the dramatic scenery of Arran

Overall, this SCU is judged to experience a **Very Low** magnitude of effect.

Significance of Effect

There would be **no effect** on the characteristics of this seascape during construction. During operation, the significance of effect on this SCU would be **Negligible (not significant)**.

1.4 Visual Amenity

1.4.1 The following tables provide an assessment of potential effects on each of the visual receptors based on the identified representative viewpoint locations. Visualisations from each of the viewpoint locations are provided in EIAR Volume 2d.

Table 14 Effects on receptors at Craighouse, Jura

Viewpoint 1: Craighouse, Jura (see Figures VP1.1 to VP1.3, EIAR Volume 2d)

Baseline Description

This viewpoint is located in the north of the settlement of Craighouse on the east coast of Jura. The majority of houses within Craighouse sit to the west of the A846, generally facing the coast.

The view towards Kintyre overlooks the Bay of Small Isles, which extends from the fore-to-midground to meet the broad expanse of the Sound of Jura that separates the island from the closest parts of mainland. A low, undulating promontory south of Craighouse restricts distant views to the south-east. The focus of the view at this location thus tends to be east, towards the expansive seascape or northwards along the Jura coast.

In the far distance, the low, undulating profile of the Kintyre peninsula is visible on the horizon. At this range (over 30km), variations in landform along the peninsula are difficult to distinguish, aside from the distinctive mountainous profile of Arran beyond. In conditions with clear visibility, operational turbines on Kintyre would be visible as very small features seen over a considerable distance; Beinn an Tuirc I and II to the south east, and to the north the small clusters of Deucheran Hill, Cour and Freasdail. Overall, the value of the view is judged to be **Medium**.

After dark, the lights of properties and streetlights at Craighouse, and occasional car headlights on the A846 are visible in the foreground, with lights on the pier and navigation beacons visible in the mid-ground and occasional lights on vessels at sea likely to be visible in the distance to the east.

Visual Sensitivity

This wireline viewpoint location is representative of the main settlement on Jura. The A846 is the main road on Jura and ferries also run from Craighouse to Tayvallich (mainland) during the summer, thus it is also representative of those travelling to, and around, the island. This location is also within the Jura NSA and receptors are likely to have a greater awareness of the landscape and views. Wind farms on Kintyre are a very small and distant component of part the view seen in the round. Taking this into account, susceptibility to change and sensitivity is judged to be **Medium**.

Magnitude of Effect - Construction

At a distance of some 31 km, views of construction activity associated within the Proposed Development infrastructure are unlikely and there would **no change**.

Viewpoint 1: Craighouse, Jura (see Figures VP1.1 to VP1.3, EIAR Volume 2d)

Magnitude of Effect – Operation

At operation, the Proposed Development would be seen as a distant feature on the Kintyre peninsula, occupying a small part of the view and in the context of other existing wind farms already present within this part of the view. The Proposed Development would not become a new focal point in the view and would be seen in the context of several existing clusters of wind turbines within the far background on the Kintyre peninsula.

The distant aviation lighting would be barely perceptible as a result of the intervening distance of over 30 km and less noticeable than other light sources in closer proximity to this location. Details of the calculated intensity for each of the lights from this location are provided in Appendix 16.11 (EIAR Volume 3).

The Proposed Development would occupy a very small horizontal extent within the view. The geographic extent of similar views would be experienced along the coastal fringe and eastern slopes of Jura. The scale of change is considered to be very small as a result of the intervening distance and the context of existing wind energy schemes on Kintyre.

Overall, the magnitude of effect is judged to be **Very Low**.

Significance of Effect

There would be **no visual effect** experienced during construction. During operation the visual effect is judged to be **Negligible (not significant)**.

Table 15 Effects on users of the B8024 south of Kilberry

Viewpoint 2: B8024 south of Kilberry (see Figures VP2.1 to VP2.4, EIAR Volume 2d)

Baseline Description

Broad and open, elevated panoramic view from the B8024 and NCR 78 looking south. To the south is Kintyre, where Gigha occupies the centre of the view and Jura sits to the west, resulting in variety across the vista and no definite focus. The Kintyre coast rises gently inland to form gently undulating hills and ridgelines, overlain by swathes of moorland and large blocks of coniferous forestry. From this distance (over 18km) it is difficult to discern the presence of built form, however there are a number of isolated individual properties situated on lower ground along much of the coastline. The existing Deucheran Hill Wind Farm punctuates the distant skyline of Kintyre, with the tops of turbines at Cour Wind Farm further north and Auchadaduie Wind Farm further south also visible in certain conditions. The small wind farm on Gigha – theoretically visible, albeit barely seen in this view – extends the influence of wind energy off the mainland and across the view.

After dark, a few distant light sources from larger settlement would be visible along the Kintyre coastline and parts of Gigha, occasional car headlights on the A83, and lights on vessels at sea and on fish farms in the Sound of Gigha.

Overall, the value of the view is judged to be **Medium**.

Viewpoint 2: B8024 south of Kilberry (see Figures VP2.1 to VP2.4, EIAR Volume 2d)

Visual Sensitivity

Users of the B road at this location are likely to be travelling for a purpose other than an appreciation of the landscape; however, this viewpoint is also representative of users of NCR 78 and this location is within an APQ and therefore views have importance to the route experience, even though they are not the primary focus. On balance, a **Medium** susceptibility and **Medium** sensitivity is assessed.

Magnitude of Effect - Construction

Views of most construction activities would be restricted by intervening moorland topography and vegetation on Kintyre. Upgrading works and movement of vehicles on the access track would form a very small and distant component of the overall view, if discernible at all. The magnitude of effect is judged to be **Very Low**.

Magnitude of Effect – Operation

The hubs of 12 of the proposed turbines would be visible along the skyline of Kintyre, seen as a distinct cluster that is evenly spaced to other schemes. The proposed turbines would be seen over 18.5 km from this location and occupy a small part of the expansive views available.

The aviation lights on the hubs of 8 turbines would be seen as distant red lights elevated slightly above the silhouette of Kintyre and the existing lights along the coastal edge. However, most receptors at this location would be travelling in a vehicle and as such their car headlights would likely diminish the perception of other external and more distant light sources. As a result of the angle of view and the distance of over 18.5 km the lighting would appear as distant features and would be of considerably lower intensity than car headlights and brake lights seen along the B8024 from this location. This location is greater than 5 km from the Proposed Development and therefore, when visible, the aviation lighting is likely to be operating on the lower intensity mode, 10% of peak intensity, reducing the impression of change. Details of the calculated intensity for each of the aviation lights from this location are provided in Appendix 16.1 (EIAR Volume 3).

Operational wind farms are visible on Kintyre further to the north and south of the Proposed Development, and as such it would not increase the horizontal extent of wind energy in the view. The geographic extent of the change would be limited to the southern coastal fringe of Knapdale, representing a short section of this overall route. The scale of change is considered to be small as a result of the intervening distance, influence of existing wind energy on Kintyre, and taking into account that the daytime focus of views would continue to be the dramatic seascape and distant islands to the south and south-west.

Overall, the magnitude of effect is judged to be **Low**.

Significance of Effect

During construction, the visual effect is judged to be **Negligible (not significant)**. During operation, the effect is judged to be **Minor (not significant)**.

Table 16 Effects on receptors at Ardpatrick

Viewpoint 3: Ardpatrick (see Figures VP3.1 to VP3.3, EIAR Volume 2d)

Baseline Description

Open, wide view from a track along the west site of West loch Tarbert near Ardpatrick. The view looks across West Loch Tarbert to Kintyre on the opposite shoreline. The lower lying settled, and farmed coastline of the peninsula is visible to the west, interspersed by areas of coastal woodland and blocks of commercial forestry. The land rises steeply beyond the settled coast, changing to an open and undulating moorland landscape. The view extends south along the profile of Kintyre where it opens to the expanse of seascape beyond the mouth of West Loch Tarbert. The low profile of Gigha is visible on the distant horizon to the south-west. There are very few built features in the view. Scattered farmsteads and dwellings are visible across the far coastline. Small-scale wind turbines are seen amid slightly elevated ground to the north-east. In good weather, the small scale Gigha and Leim wind turbines are visible on the distant horizon.

After dark, a few distant light sources from larger settlement would be visible along the Kintyre coastline, as would occasional car headlights on the A83, and lights on vessels at sea.

This is a relatively remote location with no promoted walking routes and as such it is likely to be visited by a limited number of people.

Overall, the value of the view is judged to be **Medium**.

Visual Sensitivity

This viewpoint is within the Knapdale / Melfort APQ and receptors would largely be at this location for the available views, thus have **High** susceptibility to change, resulting in a **High** sensitivity overall.

Magnitude of Effect - Construction

Views of construction activities would be screened by intervening moorland topography and vegetation on Kintyre and **no change** would be experienced from this viewpoint.

Magnitude of Effect – Operation

The blade tips of 9 of the proposed turbines would be visible from this location, over a distance of c.15 km. The hubs and towers of the proposed turbines would be screened by intervening ridge landform on Kintyre. The blade tips would appear fairly evenly spaced along the far skyline. The turbine blades would be small and distant features in the view, some of which would be barely perceptible.

No hubs would be visible; thus, no aviation lighting would be seen from this location.

The proposed turbines would occupy a small horizontal extent within the view. The ZTVs indicate that the geographic extent of change would be limited to the coastal edge to the south of Ardpatrick Point (Figures 7.6 and 7.7, EIAR Volume 2c). The scale of change is considered to be small as a result of the intervening distance, and the expansive nature of the view which contains similar features.

Overall, the magnitude of the effect is judged to be **Low**.

Significance of Effect

There would be **no visual effect** experienced during construction. During operation, the visual effect seen at this location is judged to be **Minor (not significant)**.

Table 17 Effects on users of the A83 north of Clachan

Viewpoint 4: A83 north of Clachan (see Figures VP4.1 to VP4.4, EIAR Volume 2d)

Baseline Description

Open and slightly elevated view looking south west from the A83. At this point rising landform restricts views to the west. The focus of the view is therefore towards the distant hills to the east and south east. The road is a notable human influence which characterises the immediate foreground of the view. Towards the mid-ground, the view is defined by a fabric of moorland / rough-grazing pasture, fragmented by medium scale blocks of woodland and coniferous forestry; the latter has in part been clear felled, which accentuates that this is a managed landscape. Vertical elements in the landscape comprise telegraph poles which span the view and the existing Deucheran Hill wind farm, the towers, and hubs of which break the skyline in the far distance. Freasdail Wind Farm is not visible from this point due to screening from roadside vegetation and forestry, however, is prominent in glimpsed views when traveling north on the A83 between Clachan and this point.

After dark, occasional car headlights would be visible on the A83; however, this would predominantly be a dark location. This viewpoint is representative of views from the A83 and as such would be experienced by those travelling in vehicles and the headlights would reduce the perception of other light sources.

Overall, the value of the view is judged to be **Medium**.

Visual Sensitivity

This viewpoint represents a section of open elevated views from the road. Users of the A-road would tend to be travelling at speed and the view would generally not be the primary focus. The susceptibility is assessed to be **Medium**. Overall, the sensitivity is judged to be **Medium**.

Magnitude of Effect - Construction

Views of construction activities would be screened by intervening moorland topography and vegetation on Kintyre and **no change** would be experienced from this viewpoint.

Viewpoint 4: A83 north of Clachan (see Figures VP4.1 to VP4.4, EIAR Volume 2d)

Magnitude of Effect – Operation

to the blades of 11 hubs of 2 proposed turbines would be visible from this location, seen over a distance of c.15.5 km. The visible parts of the scheme would appear as a relatively compact arrangement on the distant skyline. Fleeting blade tips of the Cour Wind Farm and the rotors and towers of the Deucheran Hill Wind Farm would be visible in the same part of the view.

The introduction of further moving vertical features would not fundamentally change the composition of this part of the view, nor become a new focus. However, the Proposed Development would increase the extent of wind energy development slightly further to the west.

Aviation lighting on the hubs of 3 turbines would theoretically be visible. In reality, intervening forestry would screen lighting on 2 of the turbines, leaving only 1 visible, seen as a distant red light along the silhouette of the Kintyre skyline. However, most receptors at this location would be travelling in a vehicle and as such their car headlights would likely diminish the perception of other external and more distant light sources. As a result of the angle of view and the distance of over 15 km the lighting would appear as a distant feature and would be of considerably lower intensity than car headlights and brake lights seen along the A83 from this location. This location is greater than 5 km from the Proposed Development and therefore, when visible, the aviation lighting is likely to be operating on the lower intensity mode, 10% of peak intensity, reducing the impression of change. Details of the calculated intensity for each of the aviation lights from this location are provided in Appendix 16.1 (EIAR Volume 3).

The proposed turbines would occupy a small horizontal extent within the view. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicates the geographic extent of change would be experienced for a very short duration at this specific location on the A83. This is one of the only points on the A83 travelling south where the Proposed Development would be visible and would represent a glimpsed view as part of a longer journey. The scale of change is considered to be small as a result of the intervening distance, and the expansive nature of the view which contains similar features.

Overall, the magnitude of the effect is judged to be **Low**.

Significance of Effect

There would be **no visual effect** experienced during construction. During operation, the visual effect seen at this location is judged to be **Minor (not significant)**.

Table 18 Effects on receptors at Dun Skeig

Viewpoint 5: Dun Skeig (see Figures VP5.1 to VP5.4, EIAR Volume 2d)

Baseline Description

360° panoramic views are available from this elevated location on Dun Skeig. The focus of views is west across West Loch Tarbert to the rugged coastline of the Knapdale peninsula, and towards the dramatic profile of Jura and Islay on the horizon. The Isle of Gigha punctuates the expanse of seascape between the Southern Hebrides and the mainland. Views south and west look across the Kintyre peninsula, from its settled and farm western coastline to the elevated undulating moorland plateau and large blocks of commercial forestry further east. The distant hills of Arran act as an additional focus to the south-east.

The Cour Wind Farm appears as a relatively distant but notable cluster along the skyline of undulating moorland to the south-east, with Freasdail Wind Farm a notable feature to the east. The Gigha / Leim Farm wind turbines are seen as small and distant features offshore to the south-west.

After dark, the lights of scattered properties inland and along the Kintyre coast and occasional car headlights on the A83 are visible as are occasional lights on vessels at sea and on fish farms in the Sound of Gigha. Property lights on Knapdale and occasional car headlights on the B8024 would also be seen in the round but are distant and less noticeable. Albeit possible, there are unlikely to be receptors at this location during darkness hours.

Overall, the value of the view is judged to be **High**.

Visual Sensitivity

This viewpoint is within the West Kintyre APQ and receptors at this location would be here to enjoy the 360° panoramic views. Views include existing wind farms. Receptors at this location are assessed as having **Medium** susceptibility to change, resulting in a **Medium** sensitivity overall.

Magnitude of Effect - Construction

Views of construction activities would be screened by intervening moorland topography and vegetation on Kintyre and **no change** would be experienced from this viewpoint.

Viewpoint 5: Dun Skeig (see Figures VP5.1 to VP5.4, EIAR Volume 2d)

Magnitude of Effect – Operation

The blades of 12 and hubs of 7 of the proposed turbines would be visible, seen over a distance of 14.5 km. The towers of the Proposed Development would be screened by intervening topography. The visible parts of the Proposed Development would appear as a relatively compact arrangement on the distant skyline. Fleeting blade tips of the Deucheran Hill Wind Farm and the rotors and towers of the Cour Wind Farm would be visible in the same part of the view. The proposed turbines would appear similar in size and horizontal extent to those of the Cour wind farm.

Aviation lighting on the hubs of 3 turbines would be visible as distant red lights, seen along the silhouette of the Kintyre skyline, although it is anticipated that few people would be at this location at night. As a result of the angle of view and the distance of over 14.5 km the intensity of the lighting would be reduced, such that when in peak mode it would appearing similar to a sodium streetlight at a distance of approximately 5 km or a car brake light at a little under 5 km distance. As this location is greater than 5 km from the Proposed Development, when visible, the aviation lighting is likely to be operating on the lower intensity mode, 10% of peak intensity, reducing the impression of change. Details of the calculated intensity for each of the aviation lights from this location are provided in Appendix 16.1 (EIAR Volume 3).

The horizontal extent of change within the expansive view would be small. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicates that the geographic extent of similar views would be contained to the upper slopes of Dun Skeig. The scale of change is judged to be low as a consequence of the intervening distance, the presence of similar features within the view, and taking into account that the main focus of the view is out to sea.

Overall, during operation the magnitude of effect is judged to be **Low**.

Significance of Effect

There would be **no visual effect** experienced during construction. During operation, the visual effect seen at this location is judged to be **Minor (not significant)**.

Table 19 Effects on passengers of the Kennacraig to Port Askaig Ferry

Viewpoint 6: Kennacraig – Port Askaig Ferry (Figure VP6.1 to VP6.4, EIAR Volume 2d)

Baseline Description

Open, expansive panoramic views from a passenger ferry sailing east from Port Ellen / Port Askaig to Kennacraig. The view looks across the expanse of the Sound of Jura, with the distinctive landform of Jura and Islay forming a focus to the west. Knapdale is seen to the north and Gigha and the Kintyre peninsula stretch into the distance to the south. The strong line of the peninsula leads the eye along its length, rising and falling with minor undulation that allows occasional glimpses to the Arran mountains beyond. The existing Cour, Deucheran Hill, Beinn an Tuirc I and II and Tangy Wind Farms are visible from this point of the journey, strung out along the skyline to the southeast and south. Freasdail Wind Farm is visible to the east of this location, with the upper portions of turbines apparent along the Kintyre ridgeline. Freasdail extends the visibility and influence of turbines further north along Kintyre and closer to this viewpoint. The Gigha and Leim Farm wind turbines are back-clothed by the dark mass of the peninsula.

After dark, the distant lights of scattered properties along the Kintyre coastline, fish farms in the Gigha Sound, and to a lesser extent on Gigha, and distant car headlights along the A83, are visible as are occasional lights on vessels at sea. The winter timetable (from 19 October 2020 - 25 March 2021[2]) indicates that (around the winter solstice) during the week five sailing per day would take place before sunrise or after sunset[3], with reduced sailings on the weekends. The ferry decks are lit, which reduces perception of distant light sources.

Overall, the value of the view is judged to be **Medium**

Visual Sensitivity

Views from the passenger ferry would be important to the experience of the journey, but not the primary focus or purpose of travelling. Existing wind farms are present in views towards Kintyre. On balance there is a **Medium** susceptibility to change. Overall, a **Medium** sensitivity is assessed.

Magnitude of Effect - Construction

Views of most construction activities would be restricted by intervening moorland topography and vegetation on Kintyre. Upgrading works and movement of vehicles on the access track may be visible in very good weather conditions but would form a very small and distant component of the overall view. The magnitude of effect is judged to be **Very Low**.

[2] https://www.calmac.co.uk/islay-kennacraig-port-ellen-port-askaig-winter-timetable (accessed 18/10/21)
[3] Calculated from Metcheck.com. Sunrise recorded as approx. 8:50 and sunset as approx. 15:50 on the winter solstice, 21/12/2020.

Viewpoint 6: Kennacraig – Port Askaig Ferry (Figure VP6.1 to VP6.4, EIAR Volume 2d)

Magnitude of Effect – Operation

The rotors of 12 of the proposed turbines and several tower sections would be visible, seen over a distance of c.15 km from this location. This location is one of the closest points on the ferry route to the Proposed Development, and therefore views from other parts of the journey would be more distant. As indicated by the ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) the Proposed Development would not be visible from the approximate 10 km section of the route within West Loch Tarbert.

Where visible, the Proposed Development would be seen in the context of other existing wind farms on Kintyre and would appear as a distinct cluster of turbines along the distant skyline, set back from the coast. From this viewpoint location the Proposed Development would appear as a noticeable new feature within the view, although it would occupy a small part of the broader panorama and would be seen in the context of existing, albeit less prominent, wind farms on Kintyre.

Aviation lighting on 8 turbines would be visible, seen as cluster of red lights along and slightly above the silhouette of the peninsula, thus introducing lighting into a new part of the view in addition to that visible along the coast. Both internal and external lighting on the ferry would influence the perception of other light sources in outward views. The low elevation of this viewpoint and the distance to the Proposed Development would result in the apparent intensity of the aviation lighting being reduced such that when in peak mode it would appear similar to a car brake light at a distance of over 5 km. As this location is greater than 5 km from the Proposed Development, when visible, the aviation lighting is likely to be operating on the lower intensity mode, 10% of peak intensity, reducing the impression of change. Details of the calculated intensity for each of the aviation lights from this location are provided in Appendix 16.1 (EIAR Volume 3).

No aviation lighting would be visible from the section of this route between the mouth of West Loch Tarbert and Kennacraig.

Wind farms are visible further to the north and south of Kintyre, thus the Proposed Development would not increase the extent of wind energy within in the view. The ZTVs (Figure 7.6 and 7.7, EIAR Volume 2c) indicate that the geographic extent of similar views would be possible for much of the sailing, although appreciated as part of a journey with a variety of sequential views which tend to draw the focus to more dramatic scenery to the north and west. The scale of change is judged to be low as a consequence of the intervening distance, the small extent of view affected and that the focus of views would tend to be elsewhere.

Overall, the magnitude of effect is judged as **Low**.

Significance of Effect

During construction, the visual effect is judged to be **Negligible (not significant)**. During operation, the visual effect seen at this location is judged to be **Minor (not significant)**.

Table 20 Effects on passengers of the Kennacraig to Port Ellen Ferry

Viewpoint 7: Kennacraig - Port Ellen Ferry (see Figures VP7.1 to VP7.4, EIAR Volume 2d)

Baseline Description

Open, expansive panoramic views from a passenger ferry sailing east from Port Ellen / Port Askaig to Kennacraig. The view looks across the expanse of the Sound of Jura, with the distinctive landform of Jura to the north, Islay to the west, Knapdale in the distance to the north-east, and Gigha and the low profile of the Kintyre mainland on the distant horizon to the east. The strong line of the peninsula leads the eye along its length, rising and falling with minor undulations allowing glimpses to the tops of the very distant Arran mountains beyond. A number of existing wind farms are visible along the peninsula. The most notable of these is a cluster formed by Beinn an Tuirc I and II and the three turbines of Auchadaduie closer to the coast. Tangy I and II form a distinct cluster further to the south and Freasdail a distant cluster in the north of the peninsula. The tips of Cour and Deucheran wind farms are potentially visible, but unlikely to be noticed by the casual observer and consequently have little influence on the baseline. The Gigha / Leim Farm schemes are noticeable in closer proximity to this location, and by virtue of being back clothed by the rising topography of Kintyre.

After dark, the distant lights of scattered properties along the Islay coastline to the west, and to a lesser extent along the Kintyre coastline and on Gigha are visible as are occasional lights on vessels at sea. The winter timetable (from 19 October 2020 - 25 March 2021[4]) indicates that (around the winter solstice) up to two sailing per day would take place approximately half an hour after sunrise or half an hour before sunset[5], and one sailing per week after that point. The ferry decks are lit, which reduces perception of distant light sources.

Overall, the value of the view is judged to be **Medium**.

Visual Sensitivity

Views from the passenger ferry would be important to the experience of the journey, but not the primary focus or purpose of travelling. A number of existing wind farms are present in views towards Kintyre. On balance a **Medium** susceptibility to change is assessed, resulting in **Medium** sensitivity.

Magnitude of Effect - Construction

Views of most construction activities would be restricted by intervening moorland topography and vegetation on Kintyre. Upgrading works and movement of vehicles on the access track may be visible in very good weather conditions but would form a very small and distant component of the overall view. The magnitude of effect is judged to be **Very Low**.

[4] https://www.calmac.co.uk/islay-kennacraig-port-ellen-port-askaig-winter-timetable (accessed 18/10/21)
[5] Calculated from Metcheck.com. Sunrise recorded as approx. 8:50 and sunset at approximately 15:50 on the winter solstice, 21/12/2020.

Viewpoint 7: Kennacraig - Port Ellen Ferry (see Figures VP7.1 to VP7.4, EIAR Volume 2d)

Magnitude of Effect – Operation

The rotors of 12 proposed turbines would be visible, seen over a distance of c.18.5 km from this location. The upper parts of towers would also be seen above the intervening Kintyre ridgeline. The array would appear evenly spaced, and comfortably separated from schemes to the north of Kintyre and the large cluster of operational wind turbines to the south. As indicated by the ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) the Proposed Development would not be visible from the approximate 10 km section of the route within West Loch Tarbert, but generally visible from the remainder of the route.

From this viewpoint location the Proposed Development would appear as a noticeable new feature within the view, although it would occupy a small part of the broader panorama and would be seen in the context of existing, albeit more distant and slightly less prominent, wind farms on Kintyre.

Aviation lighting on 8 turbines would be visible (Figure 7.8, EIAR Volume 2c), seen in the distance as a cluster of red lights along and above the silhouette of the peninsula, thus introducing lighting into a new part of the view in addition to that visible along the coast. Both internal and external lighting on the ferry would influence the perception of other light sources in outward views. The low elevation of this viewpoint and the distance to the Proposed Development would result in the apparent intensity of the aviation lighting being reduced such that when in peak mode it would appear similar to a car brake light at a distance of over 5 km. As this location is greater than 5 km from the Proposed Development, when visible, the aviation lighting is likely to be operating on the lower intensity mode, 10% of peak intensity, reducing the impression of change. Details of the calculated intensity for each of the aviation lights from this location are provided in Appendix 16.1 (EIAR Volume 3). No aviation lighting would be visible from the section of this route between the mouth of West Loch Tarbert and Kennacraig.

Wind farms are visible further to the north and south of Kintyre, thus the Proposed Development would not increase the extent of wind energy within in the view. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicates that the geographic extent of similar views would be possible for much of the sailing, although appreciated as part of a journey with a variety of sequential views which tend to draw the focus to more dramatic scenery to the north and west. The scale of change is judged to be low as a consequence of the intervening distance, small extent of the view affected and that the focus of views would tend to be elsewhere.

Overall, the magnitude of effect is judged as **Low**.

Significance of Effect

During construction, the visual effect is judged to be **Negligible (not significant)**. During operation, the visual effect seen at this location is judged to be **Minor (not significant)**.

Table 21 Effects on receptors at Ardminish, Gigha

Viewpoint 8: Ardminish, Gigha (see Figures VP8.1 to VP8.6, EIAR Volume 2d)

Baseline Description

Slightly elevated, open, and panoramic view looking east from Ardminish. The focus of this view is towards the Sound of Gigha and Kintyre mainland. The foreground of the view is characterised by rough hummocky grassland, scrub vegetation and craggy foreshore of Gigha. Small clusters of residential properties and isolated white render houses nestle within the topography. The view extends across the Sound of Gigha, and beyond to the generally uniform profile of the Kintyre coastline. The distant low undulating hills are overlain by large swathes of open moorland, fragmented by equally extensive blocks of coniferous forestry. There are a number of foreground vertical elements including telegraph poles and masts of watercraft moored offshore. The turbines of Auchadaduie Wind Farm are visible on the lower slopes above the coast to the south. In the far distance the blades and hubs of the Beinn an Tuirc I and II, Tangy I and II are also visible.

After dark, the lights of scattered properties along the near Gigha shore and the Kintyre coastline, and distant car headlights along the A83 are visible as are occasional lights on vessels at sea.

Overall, the value of the view is judged to be **Medium**.

Visual Sensitivity

This viewpoint is representative of views from the settlement at Ardminish and parts of the core path network on Gigha. Views experienced by residents in their home are generally considered to be of primary importance, indicating an elevated susceptibility to change. The focus of views from Ardminish and parts of the core path network would tend towards the Kintyre peninsula, in which existing wind farms are present. On balance a **High** susceptibility to change is assessed, resulting in **High** sensitivity.

Magnitude of Effect - Construction

Views of most construction activities would be restricted by intervening moorland topography and vegetation on Kintyre. Upgrading works and movement of vehicles on the access track may be visible in good weather conditions but would form a very small and distant component of the overall view. The magnitude of effect is judged to be **Very Low**.

Viewpoint 8: Ardminish, Gigha (see Figures VP8.1 to VP8.6, EIAR Volume 2d)

Magnitude of Effect – Operation

The rotors or parts of the rotors of all 12 proposed turbines, and upper parts of towers of 10 turbines, would be visible, seen over c. 9 km from this location and set behind the inland ridgeline of the upland interior of the Kintyre peninsula. The Proposed Development would extend the influence of wind farms within the view and would be located in closer proximity to the viewpoint than the existing schemes. The location beyond the initial upland ridge of Kintyre reduces the apparent height of the turbines. However, the Proposed Development would be a notable feature and create an additional focus in the background of part of the broad view east.

An additional supplementary wireline from Craig Bhan, the tallest hill on Gigha, is provided in Figure SW1 (EIAR Volume 2d) to give an indication of views experienced from a more elevated part of the Island. This demonstrates a broadly similar view of the Proposed Development to that experienced at Ardminish. However, it would be seen in the context of a greater impression of existing wind farms on Kintyre and within a broader panorama which includes the distant hills of Arran to the east and scenic seascape and hills of Islay, Jura and Knapdale to the west and north. As indicated by the ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) and the baseline photography from Achamore House (included as part of the Cultural Heritage assessment, Figure VP E.1, EIAR Volume 2d), visibility of the Proposed Development from other parts of the island is often more limited and restricted by landform and/or mature vegetation. Viewpoint 8: Ardminish therefore is representative of the likely worst case visual effects from receptors on the Isle of Gigha, with effects experienced from other parts of the island often reduced.

Aviation lighting on 8 turbines would be visible, seen as relatively distant red lights elevated slightly above the silhouette of the mainland ridge of Kintyre, thus introducing lighting into a new part of the view, in addition to that seen along the Kintyre coast. Night-time photomontages are provided in Figures VP8.5 and VP8.6 (EIAR Volume 2d) to give an impression of the lighting relative to other existing light sources in the view. It is important to note that these give an impression of how the lighting would appear within a photograph. In reality the lights would appear as a consistent red colour to the naked eye, without the brighter central glow. The low elevation of this viewpoint and the distance to the Proposed Development would result in the apparent intensity of the aviation lighting being reduced such that when in peak mode it would appear similar to a sodium streetlight at a distance of approximately 5 km or a car brake light at a little under 5 km distance. As this location is greater than 5 km from the Proposed Development, when visible, the aviation lighting is likely to be operating on the lower intensity mode, 10% of peak intensity, as indicated in Figure VP8.6 (EIAR Volume 2d). Details of the calculated intensity for each of the aviation lights from this location are provided in Appendix 16.1 (EIAR Volume 3).

The Proposed Development would occupy a relatively small horizontal extent within the broad view east. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicate that the geographic extent of change would, theoretically, be experienced from much of the eastern half of Gigha, although in reality would be locally reduced by the presence of variable landform, trees and woodland. The Proposed Development would be perceived as a notable feature, occupying a part of the view within the main direction of focus from this location.

Overall, the magnitude of effect is judged to be **Medium**.

Viewpoint 8: Ardminish, Gigha (see Figures VP8.1 to VP8.6, EIAR Volume 2d)

Significance of Effect

During construction, the visual effect is judged to be **Negligible (not significant)**. During operation, the visual effect experienced at this location is judged to be **Moderate (significant)**.

Table 22 Effects on receptors in the south of Gigha

Viewpoint 9: Gigha, South Pier (see Figures VP9.1 to VP9.4, EIAR Volume 2d)

Baseline Description

Open, expansive panoramic view from Gigha, on the south pier at the southern end of the island. The natural focus of the view would tend to be across the sound and southwards along the long sweep of the Kintyre peninsula.

The open expanse of the Sound of Gigha defines and separates the fore-to-mid ground of the view. A number of low-lying, small craggy islets protrude from the sound in close proximity to Gigha. In the mid to background of the view is the relatively uniform coastline of Kintyre. Seen from this location the hills rise relatively steeply from the coast. Small linear settlements are strung out along the A83 coastal road. As the topography rises, settlement is restricted to isolated farmsteads. Large blocks of coniferous forestry fragment upland areas and ridgelines; creating a textured skyline.

The Beinn an Tuirc scheme is visible as one large group of varying turbine sizes, with Auchadaduie slighting outlying at its southern extent. The Tangy schemes (I-II) form a cluster further to the south along Kintyre. The Gigha and Leim Farm schemes are visible in close proximity to the west.

After dark, lights on the pier in the immediate foreground influence the appreciation of the view. The lights of scattered properties along the Kintyre coastline are visible, as are occasional car headlights along the A83 further inland. Scattered lights of settlement on Gigha and occasional lights on vessels at sea are also visible.

Overall, the value of the view is judged to be **Medium**.

Visual Sensitivity

This view is representative of those from this small working pier. Wind farms on Kintyre are an existing component of the views. Overall, **Medium** susceptibility is assessed, resulting in **Medium** sensitivity.

Magnitude of Effect - Construction

Views of most construction activities would be restricted by intervening moorland topography and vegetation on Kintyre. Upgrading works and movement of vehicles on the access track may be visible in very good weather conditions but would form a very small and distant component of the overall view. The magnitude of effect is judged to be **Very Low**.

Viewpoint 9: Gigha, South Pier (see Figures VP9.1 to VP9.4, EIAR Volume 2d)

Magnitude of Effect – Operation

The rotors, or parts of rotors, of all 12 proposed turbines, and upper parts of towers of 11 turbines, would be visible, seen at a distance of over c.8 km and set behind the inland ridgeline of the upland interior of the Kintyre peninsula. From this direction there would be a slight separation between the Proposed Development and the large cluster of wind turbines formed by Beinn an Tuirc I and II, similar to that between this cluster and Auchadaduie to the south. Nonetheless, the Proposed Development would extend the influence of wind turbines in this part of the view further north and consequently closer to this location. The location of the Proposed Development beyond the initial upland ridge of Kintyre reduces the apparent height of the turbines. However, the Proposed Development would appear as a notable feature and create an additional focus in the background of part of the broad view east.

Aviation lighting on 8 turbines would be visible, seen as distant red lights elevated above the silhouette of the mainland ridge of Kintyre, thus introducing lighting into a new part of the view in additional to that seen along the Kintyre coast. The low elevation of this viewpoint and the distance to the Proposed Development would result in the apparent intensity of the aviation lighting being reduced such that when in peak mode it would appear similar to a sodium streetlight at a distance of approximately 5 km or a car brake light at a little under 5 km distance. As this location is greater than 5 km from the Proposed Development, when visible, the aviation lighting is likely to be operating on the lower intensity mode, 10% of peak intensity, reducing the impression of change. The existing foreground lighting on the pier is likely to have a greater influence on the night-time view and may also lessen the perception of more distant light sources such as that on the Proposed Development. Details of the calculated intensity for each of the aviation lights from this location are provided in Appendix 16.1 (EIAR Volume 3).

The Proposed Development would occupy a relatively small proportion of the horizontal field of a panoramic view in this direction. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicate the geographic extent of similar views would, theoretically, be experienced from much of the eastern half of Gigha, although in reality would be locally reduced by the presence of variable landform, trees and woodland. The Proposed Development would be perceived as a notable feature within part of the views east towards Kintyre from this location.

Overall, the magnitude of effect is judged to be **Medium**.

Significance of Effect

During construction, the visual effect is judged to be **Negligible (not significant)**. During operation, the visual effect experienced at this location is judged to be **Moderate (significant)**.

Table 23 Effects on passengers using the Gigha Ferry

Viewpoint 10: Sound of Gigha from Gigha Ferry (see Figures VP10.1 to VP10.4, EIAR Volume 2d)

Baseline Description

Open panoramic views are possible from this viewpoint located on the Gigha ferry on the Sound of Gigha. The natural focus of the view would tend towards the direction of travel. When travelling west the focus of the view is towards Gigha and along the coastline of Kintyre to the north and south. In journeys back to the mainland – represented here - views would tend to be focussed east towards the Kintyre peninsula and the undulating hills that rise steeply inland from the coast plain. The hill slopes are overlain by moorland, rough grazing, and large blocks of coniferous forestry. Built form is strung out along the coastline in the form of linear settlement, individual properties, piers and several isolated farmsteads on the lower slopes of hills. The Tangy I and II schemes are visible on the distant skyline to the south east.

After dark, the lights of the Tayinloan ferry terminal, scattered properties along the coastline, and occasional car headlights along the A83 are visible inland. Scattered lights of settlements on Gigha are also visible, as are occasional lights on vessels at sea and fish farms within the sound. The winter timetable (from 19 October 2020 - 25 March 2021[6]) indicates that (around the winter solstice) during the week one sailing per day would take place approximately half an hour before sunset[7], and three sailings after that point up to the final arrival on Gigha at approximately 17:55. During summer months no sailings would be undertaken during hours of darkness. The ferry decks are lit, which reduces perception of distant light sources.

Overall, the value of the view is judged to be **Medium**.

Visual Sensitivity

Users of the passenger ferry would be travelling between the Isle of Gigha and mainland at a relatively steady pace. Distant views of wind farms on Kintyre are a component of the view from this location. Views from the ferry are important but are generally not the primary purpose of the journey. On balance a **Medium** susceptibility to change is assessed, resulting in **Medium** sensitivity.

Magnitude of Effect - Construction

Views of most construction activities would be restricted by intervening moorland topography and vegetation on Kintyre. Upgrading works and movement of vehicles on the access track may be visible in very good weather conditions but would form a very small and relatively distant component of the overall view. The magnitude of effect is judged to be **Very Low**.

[6] https://www.calmac.co.uk/article/2929/Gigha-Tayinloan---Gigha (accessed 28/10/20)
[7] Calculated using Metcheck.com as 15:50 on the winter solstice 21/12/2020.

Viewpoint 10: Sound of Gigha from Gigha Ferry (see Figures VP10.1 to VP10.4, EIAR Volume 2d)

Magnitude of Effect – Operation

The blades of 12 proposed turbines would be visible from this location, seen over a distance of 6 km. Receptors would also see several hubs and upper tower sections set beyond the inland ridgeline on Kintyre. The proposed turbines would appear as a relatively evenly spaced array beyond the initial upland ridge of the peninsula. The Proposed Development would extend the influence of wind turbines further north and closer to this location.

Aviation lighting on 5 turbines would be theoretically visible, seen as relatively distant red lights elevated above the silhouette of the inland ridge. Both internal and external lighting on the ferry would influence the perception of other light sources in outward views. The low elevation of this viewpoint and the distance to the Proposed Development would result in the apparent intensity of the aviation lighting being reduced such that when in peak mode it would appear similar to a or a car brake light at a at a distance of a little under 5 km. As this location is greater than 5 km from the Proposed Development, when visible, the aviation lighting is likely to be operating on the lower intensity mode, 10% of peak intensity, reducing the impression of change. Details of the calculated intensity for each of the aviation lights from this location are provided in Appendix 16.1 (EIAR Volume 3). Approaching the Kintyre coast, fewer lights would be visible due to increased screening and separation by the inland upland ridge.

The Proposed Development would occupy just under 1/3rd of the horizontal field of view in this direction, a small part of the wider views available. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicate that the geographic extent of change of similar views i.e. where hubs and / or rotors may be visible, would occur over much of the duration of the sailing from Gigha to the mainland. However, there would be a steady decrease in visibility of the Proposed Development as the ferry progresses towards Kintyre, as evidenced by Viewpoint 12: Tayinloan Ferry Terminal. The scale of change is judged to be large as a result of the introduction of a prominent array of moving features to the near skyline that would become a new focus within the view.

Overall, the magnitude of effect is judged to be **Medium**.

Significance of Effect

During construction, the visual effect is judged to be **Negligible (not significant)**. During operation, the visual effect seen at this location is judged to be **Moderate (significant)**.

Table 24 Effects on receptors at Rhunahaorine / Point Sands and caravan park

Viewpoint 11:	**Rhunahaorine / Point Sands near caravan park** (see Figures VP11.1 to VP11.5, EIAR Volume 2d)

Baseline Description

Open, panoramic view from the Kintyre Way at Point Sands, Rhunahaorine. The natural focus of the view would tend towards the seascape of the Sound of Gigha, with the distinctive landform of Jura a distant focus to the north-west. There are also open views south along the length of the sweeping coastline, taking in the immediate foreshore, distant low undulating moorland and forest hills, and Sound of Gigha. Views inland to the east are generally more limited and restricted by rising topography and forestry. The tips of the Auchadaduie Wind Farm are potentially visible, but unlikely to be noticed by the casual observer and consequently have little influence on the baseline.

After dark, the lights of the nearby caravan park, at Tayinloan ferry terminal and scattered properties along the coastline, and occasional car headlights along the A83 are visible inland. Scattered lights of settlement on Gigha and at fish farms in the Gigha Sound are also visible, as are occasional lights on vessels at sea.

Overall, in recognition of the Kintyre Way being a promoted long-distance route and one of Scotland's 'Great Trails' the value of the view is judged to be **High**.

Visual Sensitivity

This viewpoint is situated within the East Kintyre Coast APQ and representative of users of the caravan park and the Kintyre Way. A **High** susceptibility to change is assessed on account of the locally recognised panoramic quality of the views for which people are likely to be in this location to enjoy, which overall is judged to result in **High** sensitivity.

Magnitude of Effect - Construction

Views of construction activities would be restricted by intervening moorland topography and vegetation on Kintyre. **No change** would be visible from this location.

Viewpoint 11: **Rhunahaorine / Point Sands near caravan park** (see Figures VP11.1 to VP11.5, EIAR Volume 2d)

Magnitude of Effect – Operation

The blades of 11 and hubs of 4 of the proposed turbines would be visible, seen over a distance of c.6 km. The visible parts of the Proposed Development would introduce vertical moving features set within the upland interior of Kintyre, separated from the settled coast by an intervening upland ridgeline and opposite the main focus of views west. The scale of the proposed turbines would be commensurate to the long, horizontal open skyline and large swathes of upland forestry.

Aviation lighting on the hubs of 2 turbines would be visible from this location, seen as relatively distant red lights slightly elevated above the silhouette of the inland ridge, thus introducing further lighting into a new part of the view. Night-time photomontages are provided in Figures VP11.5 and VP11.6 (EIAR Volume 2d) to give an impression of the lighting relative to other existing light sources in the view. It is important to note that these give an impression of how the lighting would appear within a photograph. In reality the lights would appear as a consistent red colour to the naked eye, without the brighter central glow. The low elevation of this viewpoint and the distance to the Proposed Development would result in the apparent intensity of the aviation lighting being reduced such that when in peak mode it would appear similar to a sodium streetlight or car brake light at a distance of just under 5 km. As this location is greater than 5 km from the Proposed Development, when visible, the aviation lighting is likely to be operating on the lower intensity mode, 10% of peak intensity, as indicated in Figure VP11.6 (EIAR Volume 2d). Details of the calculated intensity for each of the aviation lights from this location are provided in Appendix 16.1 (EIAR Volume 3).

The Proposed Development would affect a less important part of the panoramic views enjoyed from this location. The proposed turbines would occupy approximately ¼ of the field of view in this direction, a very small part of the wider panorama. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicate that the geographic extent of similar views would be contained to western parts of Rhunahaorine Point and between the coastline and foreshore, and that visibility would diminish inland. An additional supplementary wireline from another nearby location on the Kintyre Way is provided in Figure SW2 (EIAR Volume 2d), as requested by ABC. This location is at the point at which the Kintyre Way cuts slightly inland, with less restricted views than the section further north, and demonstrates a broadly similar view of the Proposed Development, albeit slightly more distant and with a small increase in visibility. In reality foreground vegetation is likely to partially limit visibility to the Proposed Development from this location.

The scale of change from the Point Sands (as represented by Viewpoint 11) and from Rhunahaorine Point (as represented by supplementary wireline SW2) would be medium to low as although new features would be added to the skyline, they would be largely screened by the inland upland ridgeline and seen within the context of open moorland and large-scale forestry in the background of the view and opposite to the more scenic views west.

On balance, the magnitude of effect is judged to be **Low**.

Significance of Effect

During construction there would be **no visual effect** at this location. During operation, the visual effect experienced at this location is judged to be **Minor (not significant)**.

Table 25 Effects on receptors at Tayinloan Ferry Terminal

Viewpoint 12: Tayinloan Ferry Terminal (see Figures VP12.1 to VP12.4, EIAR Volume 2d)

Baseline Description

The focus of the view from this location is towards the seascape of the Sound of Gigha to the west. Views inland are across the car park at Tayinloan Ferry Terminal towards the rising upland moorland and forest landscape beyond. The foreground of the view is characterised by the visual clutter of the car park, associated buildings, and infrastructure of Tayinloan Ferry Terminal. Beyond and to the middle-ground of the view, the gently sloping hills rise inland from the coastline. The skyline is generally open, although punctuated by foreground elements. Large blocks of woodland add texture to the skyline at irregular intervals across the moorland and atop distant high points.

After dark there are a number of light sources in the foreground of the view, including along the pier and at the café and residential properties to the north and south. Further scattered lights are visible along the Kintyre coast, particularly to the south, along with car headlights on the A83. The lights of settlement along Gigha and fish farms can be seen to the west.

Overall, the value of the view is judged to be **Medium**.

Visual Sensitivity

The viewpoint is within an APQ associated with coastal / seascape views, thus is considered to have a **Medium** susceptibility to change. The sensitivity of the location is judged to be **Medium**.

Magnitude of Effect - Construction

Views of construction activities would be restricted by intervening moorland topography and vegetation on Kintyre, and by built form within Tayinloan. **No change** would be visible from this location.

Viewpoint 12: Tayinloan Ferry Terminal (see Figures VP12.1 to VP12.4, EIAR Volume 2d)

Magnitude of Effect – Operation

The rotor of 1 and the blades of 9 proposed turbines, would be seen over a distance of c.4.5 km, although the blade tips of at least 2 of the turbines would be barely perceptible. The Proposed Development would introduce vertical moving features to views of the uplands seen from this location, separated from the coastal strip by the intervening inland ridgeline. The scale of the proposed turbines would be commensurate to the long, horizontal open skyline and large swathes of upland forestry.

Aviation lighting on 1 hub would be visible, seen as a relatively distant red light elevated slightly above, and beyond, the silhouette of the inland ridge of the upland interior of the Kintyre peninsula. As a result of the angle of view and the distance of approximately 4.5 km the light would be seen as a minor feature in the view, with other foreground light sources having a greater influence on the night-time view. Details of the calculated intensity of the aviation light from this location are provided in Appendix 16.1 (EIAR Volume 3).

The Proposed Development would affect a less important part of the panoramic views enjoyed from this location. The proposed turbines would occupy approximately 1/3rd of the field of view in this direction, a very small part of the wider views experienced. The ZTVs (Figure 7.6 and 7.7, EIAR Volume 2c) indicate that the geographic extent of similar views would be contained around the ferry terminal and to the north around Rhunahaorine Point, with visibility quickly becoming more limited further inland. From the main Tayinloan settlement, located to the south-east of the viewpoint, visibility of the Proposed Development would be more restricted such that there would be very little, if any, perceptual change from most locations.

The scale of change experienced from the viewpoint would be small as a result of the limited and less important part of the view affected, the separating effect of the inland ridgeline and context of open moorland and large-scale forestry in the background of the view, and the context of foreground lighting in the view at night.

Overall, the magnitude of effect is judged to be **Low**.

Significance of Effect

During construction there would be **no visual effect** at this location. During operation, the visual effect seen at this location is judged to be **Minor (not significant)**.

Table 26 Effects on users of the Kintyre Way adjacent to the Development Site

Viewpoint 13:	**Kintyre Way north of Development Site** (see Figures VP13.1 to VP13.4, EIAR Volume 2d)

Baseline Description

Open and slightly elevated view from the Kintyre Way, one of Scotland's 'Great Trails'. The view looks across open moorland to the near horizon formed by the undulating topography, minor ridgelines, and craggy knolls. The focus of this segment of the view is across Loch na Naich, however 360-degree views are possible from this location. The view illustrates that this is a large scale, relatively simple landscape comprising forestry, open moorland, large scale landscape features in the form of the Loch and rolling to undulating topography. Wind energy is a feature of the experience from this section of the route; the existing Deucheran Hill Wind Farm can be seen to the east of this view.

After dark there are no notable light sources visible at this location. Albeit possible, there are unlikely to be receptors at this location during darkness hours.

Overall, in recognition of the Kintyre Way being a promoted long-distance route and one of Scotland's 'Great Trails' the value of the view is judged to be **High**.

Visual Sensitivity

This is a popular walking route and people are likely to be at this location for an appreciation of the landscape. A number of existing wind farms, including most notable Deucheran Hill Wind Farm, are features of the experience from this section of the route. On balance, the susceptibility to change to the type of development proposed would be **Medium**. The sensitivity is judged to be **High**.

Magnitude of Effect - Construction

Users of the Kintyre Way may appreciate an increase in vehicular traffic during construction. Close range views of construction activity associated with the access track would be seen in the foreground and midground of the view. Views of construction activity around the substation and within the Development Site to the south are likely to be screened by intervening undulating landform, which falls away gently to the south of this location, and by forestry within the Development Site boundary.

The scale of change during construction would be medium, taking into consideration the context of existing forestry operations and wind farm maintenance. The horizontal extent of construction activity would be large near the access track, diminishing with increasing distance. The geographic extent of change would be limited to a short section of the Kintyre Way before the route passes into commercial forestry to the east and west of this location. The magnitude of effect during construction experienced from this section of the Kintyre Way would be **Medium**.

Viewpoint 13: **Kintyre Way north of Development Site** (see Figures VP13.1 to VP13.4, EIAR Volume 2d)

Magnitude of Effect – Operation

The blades of 12 proposed turbines, and hubs of 8 turbines, would be theoretically visible from this location, the closest of which at a distance of c.1.5 km. In reality, forestry would screen 2 of the turbine hubs. The lower tower sections of 7 turbines would also be screened below the near skyline. The size of the proposed turbines would be large but commensurate to the scale of the surrounding open undulating moorland topography and large swathes of commercial forestry. Within this landscape and taking into account they are seen in different parts of the views from this location, variation in turbine size between the Proposed Development and Deucheran Hill and Cour wind farms would be somewhat moderated.

Aviation lighting on the hubs of 6 turbines would be theoretically visible in relative close proximity, although in reality 2 two of the aviation lights would be screened by forestry. The remaining 4 would be seen as red lights slightly elevated above the silhouette of the surrounding landform and forestry. As a result of the close proximity the aviation lights would introduce a new notable feature into the predominantly dark views from this location. However, there are unlikely to be people at this location at night to experience the change. Details of the calculated intensity of the aviation light from this location are provided in Appendix 16.1 (EIAR Volume 3).

The proposed turbines would occupy approximately 1/3rd of the field of view in this direction. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicate that similar views would be theoretically visible across a short section of the Kintyre Way to the north of the Development Site. In actuality, the screening effect of commercial forestry would reduce the duration of similar views to c.1.5-2 km of this long-distance route. The scale of the change is considered to be large as a result of, the close proximity to the Proposed Development, introduction of wind turbines into a new part of views available from this location, and the visibility of aviation lights.

The magnitude of effect experienced at the viewpoint location is judged to be **High**.

Kintyre Way Overall Route

This viewpoint represents the 'worst case' view from a static point on the Kintyre Way. Two other viewpoints (VP11: Rhunahaorine/ Point Sands and VP12: Tayinloan Ferry Terminal), described above, are also located on the Kintyre Way. These viewpoints give an indication of potential views from two short sections of the Kintyre Way. However, as demonstrated by the ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c), and as a result of the site selection guided by the RWE viewshed model, there would be no visibility of the Proposed Development from the majority of the route. In reality visibility would be further limited by screening from forestry. As such, although the Proposed Development would be a notable feature from localised locations, this would represent a very small change to views experienced from the overall route resulting in a **Low** magnitude of effect.

Significance of Effect

The visual effect experienced at this location is judged to be **Moderate (significant)** during construction and **Major (**significant**)** during operation. Effects on the wider extent of the Kintyre Way would be **Minor (not significant)**.

Table 27 Effects on receptors at A'Chleit

Viewpoint 14: A'Chleit (see Figures VP14.1 to VP14.4, EIAR Volume 2d)

Baseline Description

There are open, panoramic views from A'Chleit, with the main focus to the seascape and distant, distinctive landforms of Gigha, Islay and Jura to the north-west. From this location, views are restricted to the north by the cluster of buildings, and by steeply rising landform to the east, whereas long uninterrupted views are available south along the coastline. These views contain a contrast of built form, inland pastoral grazing land, and the sweeping seascape. The Gigha / Leim Farm turbines are a small and relatively distant feature seen off the coast to the north-west.

After dark, the lights of the nearby cluster of properties along the coastline, and occasional car headlights along the A83 are visible inland. Scattered lights of settlement on Gigha are also visible, as are occasional lights on vessels at sea.

Overall, the value of the view is judged to be **Medium**.

Visual Sensitivity

This viewpoint is situated within the West Kintyre Coast APQ and representative of visitors to A'Chleit. A **High** susceptibility to change is assessed on account of the locally recognised panoramic quality of the views for which people are likely to be in this location to enjoy, which overall is judged to result in **High** sensitivity.

Magnitude of Effect - Construction

Views of construction activities would be screened by intervening topography and vegetation on Kintyre, and by built form to the north of A'Chleit. **No change** would be visible from this location.

Magnitude of Effect – Operation

The blades of 5 turbines would be theoretically visible, seen over c.2.7 km, although 1 of these would be screened by forestry. The Proposed Development would introduce a compact array of vertical moving features seen on the upland skyline, separated from the coast, and lower lying settled landscapes by an intervening inland ridgeline. The scale of the proposed turbines would be commensurate to the long, horizontal open skyline and large swathes of upland forestry in the background of the view.

No aviation lighting would be visible from this location due to screening from landform and forestry.

The Proposed Development would affect a less important part of the panoramic views enjoyed from this location. The proposed turbines would occupy approximately ¼ of the field of view in this direction and a very small part of the wider panorama. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicate that the geographic extent of similar views would be gained from a very localised area around the A'Chleit headland. The scale of change would be small as a result of the introduction of moving features to the near skyline, moderated by the screening and separating effect of the inland ridgeline, and taking into consideration that the focus of views is towards the sea.

Overall, the magnitude of effect is judged to be **Low**.

Significance of Effect

During construction there would be no visual effect at this location. During operation, the visual effect seen at this location is judged to be **Minor (not significant)**.

Table 28 Effects on receptors in the Sound of Gigha

Viewpoint 15: **Sound of Gigha from recreational watercraft** (see Figures VP15.1 to VP15.4, EIAR Volume 2d)

Baseline Description

View from a recreational watercraft on the Sound of Gigha, west of Muasdale. The focus of this view will vary depending on the direction of travel, however, would naturally tend towards the dramatic views to Gigha, Islay and Jura to the west. From the mid to the background of the view, the uniform coastline of Kintyre rises inland to form a series of low undulating hills. Settlement is visible along the line of the A83 coast road and includes Muasdale, a number of individual properties and small hamlets strung out along the coastline. The existing Beinn an Tuirc I and II wind farms are visible between two higher shoulders of landform to the south east set back from the coastal area, with Auchadaduie[8] Wind Farm in front of the ridge and closer to the coast. The Tangy I and II schemes are visible but more distant to the south east of this location, becoming more prominent as one travels south towards Machrihanish Bay. The prominence and influence of each of the wind farms on Kintyre and Gigha would vary in different parts of the Sound of Gigha.

After dark, the lights of scattered properties along the Kintyre coast and on Gigha and adjacent fish farms are visible, as well as the movement of occasional car headlights along the A83 and potentially lights from other vessels at sea. Low intensity aviation lighting on the Auchadaduie scheme may also be visible in certain conditions.

Overall, the value of the view is judged to be **Medium**.

Visual Sensitivity

Users of recreational watercraft are likely to be at this location to enjoy the panoramic views from the Sound of Gigha. Views towards Kintyre would be less important and include a number of existing wind farms. On balance the susceptibility to change is considered to be **Medium**. The sensitivity of the view is judged to be **Medium**.

Magnitude of Effect - Construction

Between the steeply rising landform on Kintyre, and intervening vegetation on the low-lying hills and forestry within the upland moorland views of construction activity would be screened from this location and **no change** would occur.

[8] Refer to consultation feedback from NatureScot in Section 7.1.

Viewpoint 15: **Sound of Gigha from recreational watercraft** (see Figures VP15.1 to VP15.4, EIAR Volume 2d)

Magnitude of Effect – Operation

During operation, the rotors and upper tower sections of 12 proposed turbines would be visible, seen at a distance of over c.6 km. The Proposed Development would be located beyond a ridge within the undulating moorland interior, separated from the settled coast by an intervening ridgeline. This intervening landform would generally restrict views to the upper portions of towers, with a greater proportion of one turbine visible where the ridgeline is slightly lower. The scale of the proposed turbines would be commensurate to the long, horizontal open skyline and large swathes of upland forestry of the landscape it is sited within.

Aviation lighting on 8 turbines would be visible, albeit with few people likely to be at this location at night. The lighting would be seen as a relatively distant and evenly spread array of red lights elevated above the silhouette of the peninsula, introducing lights into a new part of the view in addition to those at Muasdale and along the Kintyre coast. The low elevation of this viewpoint and the distance to the Proposed Development would result in the apparent intensity of the aviation lighting being reduced such that when in peak mode it would appear similar to a car brake light at a distance of a little under 5 km. As this location is greater than 5 km from the Proposed Development, when visible, the aviation lighting is likely to be operating on the lower intensity mode, 10% of peak intensity, reducing the impression of change. Details of the calculated intensity for each of the aviation lights from this location are provided in Appendix 16.1 (EIAR Volume 3).

The horizontal extent of the scheme within this part of the expansive view is small. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicate that theoretical visibility would be extensive across the Sound of Gigha, but that the number and extent of turbines visible would steadily decrease in closer proximity to the mainland coastline from which potential visibility is generally very limited or non-existent. The scale of change would be medium as a result of the introduction of large-scale moving features being added to the skyline, partly moderated by the separating effect of the inland ridgeline and context of open moorland and large-scale forestry in the background of the view.

Overall, the magnitude of effect at this location is judged to be **Medium**.

Significance of Effect

During construction there would be **no visual effect** at this location. During operation, the visual effect seen at this location is judged to be **Moderate (significant)**.

Table 29 Effects on receptors at North Muasdale

Viewpoint 16: North Muasdale (see Figures VP16.1 to VP16.4, EIAR Volume 2d)

Baseline Description

Open view looking north-east along the line of a farm / forestry track (Core Path C293) to the east of North Muasdale. Views are channelled along the shallow valley of Clachaig Water by a combination of rising topography to the north and south of this location. A series of forested upland ridges form the backdrop to the view east. Views from the adjacent house at North Muasdale farm are focussed west towards the dramatic seascape with distinct forms of the islands creating a distant focus. There are no obvious detractors in the view, but the visual context is one of commonplace rough grazed upland and forestry.

After dark lights at the adjacent house and farm of North Muasdale and a few other scattered houses further east are visible, with occasional car headlights seen to the south-west along the A83.

Overall, the value of the view is judged to be **Medium**.

Visual Sensitivity

This is a locally important walking route. People are likely to be at this location in part for an appreciation of the landscape and as such a **Medium** susceptibility to change is assessed, resulting in **Medium** sensitivity.

Magnitude of Effect - Construction

During construction, short-duration activities associated with the Proposed Development infrastructure would be perceived, although views to tracks and ancillary structures would be restricted by intervening forestry. The scale of change would be small on account of the presence of existing forestry operations, and screening effect of intervening vegetation. Visible construction activity would be present within a small horizontal extent of the view. The geographic extent of change would be perceived from a localised area along the Clachaig Glen. The magnitude of effect during construction would be **Very Low**.

Magnitude of Effect – Operation

The rotors and varying proportions of towers of 11 proposed turbines would be visible, seen over c.3.3 km. Intervening landform and forestry would partially restrict views of lower parts of the towers, slightly reducing their apparent height. The Proposed Development would appear as a relatively compact array forming a new and prominent focus framed by landform within views east. There would be no view of the Proposed Development from the adjacent house at North Muasdale due to screening from adjacent outbuildings.

Aviation lighting on 7 turbines would be visible, seen as a group of red lights slightly elevated above the silhouette of the surrounding landform and forestry. The lights would add new features into a predominantly dark part of the view from this location, although with more limited visibility from the adjacent residential properties. As a result of the angle of view the lighting would appear at a lower intensity, reducing the impression of change. Details of the calculated intensity for each of the aviation lights from this location are provided in Appendix 16.1 (EIAR Volume 3).

The Proposed Development would occupy approximately 1/3rd of the horizontal field of view in this direction, with adjacent residential properties orientated in other directions. The geographic extent of similar views would be experienced from localised areas of the Clachaig Glen and North Muasdale. There would be no visibility of the Proposed Development from the nearby settlement of Muasdale due to screening from landform. The scale of the change at this viewpoint is considered to be large as a result of the introduction of large moving structures at close proximity, which would become a new focus within the view.

Overall, the magnitude of the effect on the view is judged to be **High**.

Viewpoint 16: North Muasdale (see Figures VP16.1 to VP16.4, EIAR Volume 2d)

Significance of Effect

The visual effect seen at this location is judged to be **Negligible (not significant)** during construction, and **Moderate (significant)** during operation.

Table 30 Effects on users of the A83 south of Muasdale

Viewpoint 17: A83 south of Muasdale (see Figures VP17.1 to VP17.4, EIAR Volume 2d)

Baseline Description

This is not a publicly accessible location but was selected in consultation with NatureScot to be representative of views experienced from this section of the A83, travelling north.

This is an open and slightly elevated view looking northwards from the A83. Rising landform restricts views to the east. The focus of the view for receptors on the A83 is therefore along the line of the road, and to the open and expansive seascape to the west. Roadside vegetation interrupts the near coastline, with more distant mid-background views containing scattered farmsteads and the A83 that lie along the settled coast. There are distant views to the dramatic outline of the Paps of Jura and Islay, with the Isle of Gigha lying between them and the mainland. The Gigha and Leim Farm wind turbines are visible, back-clothed by the distant Paps of Jura. The viewpoint is located in part of the West Kintyre APQ.

After dark, the lights on a small number of scattered properties to the north and car headlights on the A83 would be visible; however, this would predominantly be a dark location. This viewpoint is representative of views from the A83 and as such would be experienced by those travelling in vehicles and the headlights would reduce the perception of other light sources.

Overall, the value of the view is judged to be **Medium**.

Visual Sensitivity

Users of the A-road at this location are likely to be travelling for a purpose other than an appreciation of the landscape; however, this location is within an APQ and it is likely that views have some importance to the overall experience of the route. On balance, a **Medium** susceptibility and **Medium** sensitivity is assessed.

Magnitude of Effect - Construction

Views of construction activities would be screened by intervening moorland topography and vegetation on Kintyre. **No change** within the Development Site would be visible from this location.

Viewpoint 17: A83 south of Muasdale (see Figures VP17.1 to VP17.4, EIAR Volume 2d)

Magnitude of Effect – Operation

The blades of 5 proposed turbines would be partially visible, seen over a distance of c.4.5 km. Intervening landform would screen the majority of the Proposed Development and as such it would appear as a minor feature within the view, separated from the coast, and lower lying settled landscapes by an inland ridgeline.

No aviation lighting would be visible from this location.

The proposed turbines occupy a small horizontal extent, within a less important part of the panoramic views enjoyed from this location. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicate that the geographic extent of similar views would be gained for a very short duration when travelling north at this location and as such this would represent a glimpsed view. Overall, there is very limited visibility of the Proposed Development from the A83 travelling north, with most views screened by topography and vegetation. The scale of change would be very small and away from the main focus of views which is towards the sea.

Overall, the magnitude of effect is judged to be **Very Low**.

Significance of Effect

During construction there would be **no visual effect** at this location. During operation, the visual effect seen at this location is judged to be **Negligible (not significant)**.

Table 31 Effects on receptors at Glenacardoch

Viewpoint 18: Glenacardoch (see Figures VP18.1 to VP18.4, EIAR Volume 2d)

Baseline Description

There are open, panoramic views from Glenacardoch, with the main focus being the seascape and distinct landforms of Islay and Jura to the west. Views inland to the east are slightly more restricted, with distant views limited by rising landform in the mid-ground. These views contain a series of individual and small clusters of properties, farmsteads, and outbuildings, surrounded by pastoral grazing land, which punctuate the landscape along the coast. From the mid to background of the view are a series of larger undulating to rolling hills, overlain by moorland and large blocks / swathes of coniferous forestry. The Auchadaduie Wind Farm is a feature along the upland skyline in views south east, with Beinn an Tuirc I and II also visible in the same part of the view, but more distant.

After dark, the lights of properties scattered along the coastline to the north and more notably inland to the east, together with occasional car headlights along the A83, are visible. The low intensity aviation lighting on Auchadaduie Wind Farm is also visible in certain conditions.

Overall, the value of the view is judged to be **Medium**.

Visual Sensitivity

This viewpoint is representative of residential receptors for which views are likely to be important and as such the susceptibility to change is considered to be high. On balance, the sensitivity is judged to be **Medium**.

Magnitude of Effect - Construction

Views of construction activities would be screened by intervening topography and vegetation on Kintyre. **No change** within the Development Site would be visible from this location.

Viewpoint 18: Glenacardoch (see Figures VP18.1 to VP18.4, EIAR Volume 2d)

Magnitude of Effect – Operation

The hubs of 5 and blades of 11 of the proposed turbines would theoretically be visible from this location, seen over a distance of c.6 km. Intervening forestry would screen parts of the rotors and blades, reducing their prominence. The array would appear as a compact feature on the upland skyline, similar to existing forms seen in successive views to the south. The scale of the proposed turbines would be commensurate to the long, undulating skyline and large swathes of upland forestry in the background. The size of the proposed turbines relative to settlement is difficult to appreciate as a result of the intervening screening landform.

Aviation lighting on the hubs of 3 turbines would be theoretically visible. In reality, intervening forestry would screen lighting on 2 of the turbines, leaving only 1 visible, seen as a relatively distant red light along the silhouette of the inland ridgeline. As a result of the angle of view and the distance of approximately 6 km the lighting would be seen as a relatively minor feature occupying a small part of the view and appearing of a lower intensity than existing car headlights and brake lights on the A83. Details of the calculated intensity for each of the aviation lights from this location are provided in Appendix 16.1 (EIAR Volume 3).

The Proposed Development would occupy a small horizontal extent of a less important part of the view. The ZTVs (Figure 7.6 and 7.7, EIAR Volume 2c) indicates that similar views would be theoretically visible across part of the Glenacardoch headland becoming more restricted by topography inland to the east. Visibility of the Proposed Development from the small settlements of Belloch and Glenbarr east of the A83, and including the adjacent war memorial, would be heavily restricted as such there would be limited perception of change.

The scale of change from the viewpoint location is judged to be small as a result of the introduction of moving vertical features into a new part of the view, the relationship to wind energy development in successive views, and taking into account that the focus of views is the seascape to the west.

Overall, the magnitude of effect on the view is judged to be **Low**.

Significance of Effect

During construction there would be **no visual effect** at this location. During operation, the visual effect seen at this location is judged to be **Minor (not significant)**.

Table 32 Effects on receptors at Beinn an Tuirc summit

Viewpoint 19: Beinn an Tuirc (see Figures VP19.1 to VP19.4, EIAR Volume 2d)

Baseline Description

Open and elevated 360° panoramic view from the top of Beinn an Tuirc. The focus of views would tend towards the distant dramatic peaks of Jura and Arran, to the north- west and east respectively. The ground falls away steeply to the north-west of this location, allowing views across the undulating, open moorland of upland Kintyre which defines the mid-ground of the view. Beinn an Tuirc I and II wind farms form a very prominent feature in the foreground, with a number of other wind farms also visible, including Auchadaduie, Leim Farm and Gigha to the west, Tangy I and II to the south-west, and Deucheran Hill, Cour and Freasdail to the north.

After dark, lights of distant settlement at Carradale, on Gigha and Arran would be perceptible, as would occasionally lights on vessels at sea. The low intensity aviation light on Auchadaduie Wind Farm may also be visible in certain conditions. However, this would predominantly be a dark location. Albeit possible, there are unlikely to be receptors at this location during darkness hours.

Overall, the value of the view is judged to be **Low**.

Visual Sensitivity

Receptors at this location would be here to enjoy elevated panoramic views. At this location existing wind energy schemes have a defining influence on the view. On balance, susceptibility to change is considered to be **Medium**. Overall, the view is judged to have **Low** sensitivity.

Magnitude of Effect - Construction

Construction activity on part of the Development Site may be visible, where not screened by an intervening ridge and gentle undulating high points to the north-west. Activity associated with removal of forested areas (‘key-holing’) to accommodate the proposed wind turbines, and on sections of access tracks may be possible at a distance of over 6 km. The scale of change during construction is judged to be small because of the intervening distance, the context of a number of large moving structures in the foreground and forestry operations that take place within the moorland interior. The magnitude of effect is judged to be **Very Low**.

Viewpoint 19: Beinn an Tuirc (see Figures VP19.1 to VP19.4, EIAR Volume 2d)

Magnitude of Effect – Operation

12 turbines would be visible from this location, seen over c.6.1 km. Almost the full height of the proposed turbines would be appreciated, with only the bases and lower sections partly screened by forestry and landform. Given the number of wind turbines in the view, seen over a variety of distances, the difference in size of the Proposed Development relative to other schemes would be difficult to appreciate.

Aviation lighting on 8 turbines would be theoretically visible, seen as a distant and relatively evenly spread group of red lights below the horizon to the north-west. The aviation lights would introduce a new feature into the predominantly dark views at this location. The distance of over 6 km would reduce the prominence of the lights somewhat, and in most cases if visible from this location the lights would be operating on the lower intensity mode. It is unlikely that people would be at this location at night and as such the change described would generally not be experienced in reality.

The array would occupy a small part of the horizontal field of this broad panoramic view. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicate that theoretical visibility would be contained to the north-west shoulder of Beinn an Tuirc. The scale of change would be small taking into account the influence of a variety of existing wind energy development within different parts of the view. The Proposed Development is more distant than other schemes and would appear at scale with other wind turbines seen in the round, and not, therefore, become a new focus in the view; they would add additional vertical moving features into the mid-ground of a view strongly defined by similar forms. Aviation lights may be a notable, but few if any people would be at this location at night.

Overall, the magnitude of effect is judged to be **Low**.

Significance of Effect

During construction, the visual effect is judged to be **Negligible (not significant)**. During operation, the visual effect seen at this location is judged to be **Minor (not significant)**.

Table 33 Effects on users of the A83 near Bellochantuy

Viewpoint 20: A83 near Bellochantuy (see Figures VP20.1 to VP20.4, EIAR Volume 2d)

Baseline Description

This viewpoint is located on the A83 where it rounds the headland south of Bellochantuy. There is a concentration of built form within the immediate view in the form of settlement at Bellochantuy, the A83 and associated signage, and post and wire fencing that encloses the highway. Steeply rising inland topography restricts views to the south and east, providing contrast with, and directing the focus to, the wide expanse of views north and west across the Sound of Gigha to Islay, Jura and along the Kintyre coastline. Gigha and Leim Farm turbines would be visible offshore to the north.

After dark, the lights of properties at Bellochantuy and those scattered further north along the coastline, together with occasional car headlights along the A83, are visible. Away from settlement this is a generally dark location, recognised by the Kintyre Dark Sky Discovery site[9] which notes that in close proximity to the Putechan Hotel there are vantages in most directions, and no light pollution. Dark Sky Discovery sites are not designated, or recognised by planning policy, they can be nominated provided they meet a balance of criteria that includes the size of the site, it's darkness (at the lower threshold, this means away from, or shielded from, bright lights such as streetlights, security lights or approaching car headlights), sightlines, and accessibility. This viewpoint is representative of views from the A83 and as such would be experienced by those travelling in vehicles and the headlights would reduce the perception of other light sources.

Overall, the value of the view is judged to be **Medium**.

Visual Sensitivity

This view is representative of users of the A83. However, the viewpoint is situated within an APQ associated with attractive, outward looking sea views. On balance, a **Medium** susceptibility to change is assessed. Overall, the view is judged to have **Medium** sensitivity.

Magnitude of Effect - Construction

Views of construction activities would be restricted by intervening moorland topography and vegetation on Kintyre. **No change** within the Development Site would be visible from this location.

[9] https://www.darkskydiscovery.org.uk/dark-sky-discovery-sites/map.html (accessed 28/10/20)

Viewpoint 20: A83 near Bellochantuy (see Figures VP20.1 to VP20.4, EIAR Volume 2d)

Magnitude of Effect – Operation

4 blade tips would be visible, seen at a distance of over 10 km. Intervening landform would screen the rest of the Proposed Development and as such it would appear as a minor feature within the view, separated from the coast, and lower lying settled landscapes by an inland ridgeline. The size of the proposed turbines relative to foreground built form is difficult to appreciate as a result of the intervening screening landform.

No aviation lighting would be seen from this location due to screening by intervening landform.

The horizontal extent would be small within the wide view and the ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicate theoretical would be experienced for a very limited duration when travelling north on the A83 at this location and as such it represents a glimpsed view. Overall, there is very limited visibility of the Proposed Development from the A83 travelling north, with most views screened by topography and vegetation. The scale of change resulting from the Proposed Development is considered to be very low due to the limited portions of the turbines that would be visible, their location in a less important part of the view and the glimpsed nature of the view.

Overall, the magnitude of effect is judged to be **Very Low**.

Significance of Effect

During construction there would be **no visual effect** at this location. During operation, the visual effect seen at this location is judged to be **Negligible (not significant)**.

Table 34 Effects on passengers of the Lochranza to Claonaig Ferry

Viewpoint 21: Lochranza to Claonaig Ferry (see Figures VP21.1 to VP21.4, EIAR Volume 2d)

Baseline Description

Open, expansive view from a passenger ferry sailing between Claonaig and Lochranza on the Isle of Arran. The sailing time is relatively short (circa 30 minutes) when compared to other ferry routes in the area. On the eastward journey the focus of passenger's views would tend towards the dramatic peaks of the Arran mountains. On the westward sailing, observer's attention would likely switch from the view leaving Arran towards the mainland.

The low profile of the Kintyre peninsula limits views to the west. From this point on the sailing parts of the upland moorland can be appreciated. As the ferry approaches the coastline the perspective changes and the steep rising slopes further restrict views to the interior of the peninsula. From this location several wind farms can be seen punctuating the skyline of Kintyre, namely Beinn an Tuirc I and II and Deucheran Hill in the distance to the south. Cour Wind Farm is visible in a relatively prominent location on the ridge to the south west, in close proximity to, however appearing as a larger scale feature than Deucheran Hill Wind Farm. The tops of a number of turbines of Freasdail Wind Farm are visible to the north-west, forming a notable feature and further extending and reinforcing the influence of wind farms on the view.

After dark, the lights of distant scattered properties along the coastlines on Arran and Kintyre are visible, and occasional car headlights along coastal roads and on vessels out at sea. The most notable light sources from this location are in and around Lochranza on Arran. The winter timetable (from 19 October 2020 - 25 March 2021[10]) indicates that for the first 6 days of the timetable, up to the end of daylight savings one sailing per day would take place approximately half an hour before sunset and one sailing after that point. After the end of daylight savings until 25 March 2021 the service reduces to one sailing a day in each direction, operated from Tarbert instead of Claonaig. The timetable indicates that (around the winter solstice) one sailing a day would take place within half an hour before sunset. During summer months no sailings would be undertaken during hours of darkness. The ferry passenger lounge and decks are lit, which reduces perception of external light sources.

Overall, the value of the view is judged to be **Medium**.

Visual Sensitivity

Views from the passenger ferry would be important to the experience of the journey for most travellers. Views towards Kintyre, experienced across a long duration, include existing wind farms. On balance a **Medium** susceptibility to change, and **Medium** sensitivity is assessed.

Magnitude of Effect - Construction

Views of construction activities would be screened by intervening moorland topography and vegetation on Kintyre. **No change** within the Development Site would be visible from this location.

[10] https://www.calmac.co.uk/article/2929/Gigha-Tayinloan---Gigha (accessed 28/10/20)

Viewpoint 21: Lochranza to Claonaig Ferry (see Figures VP21.1 to VP21.4, EIAR Volume 2d)

Magnitude of Effect – Operation

The hubs of 2 and blades of 7 proposed turbines would be visible, seen over a distance of approximately 20 km. The Proposed Development would be seen within the same part of the view, and largely behind, the existing Deucheran Hill scheme, although in certain conditions may appear to slightly reduce the separation between this and the Cour scheme further north. Given the distance and intervening screening features, for most people, the Proposed Development would read as a minor extension of the Deucheran Hill scheme; one of several clusters of wind turbines along the Kintyre peninsula seen in combined and successive views from this location.

Aviation lighting on 1 turbine hub would potentially be visible as a distant red light along the silhouette of the Kintyre peninsula. Given the distance this is likely to appear as a minor feature, visible from up to half the journey on a very limited number of sailings. Lights within the passenger lounge and on the decks are likely to influence and limit the perception of external light sources. As this location is greater than 5 km from the Proposed Development, when visible, the aviation lighting is likely to be operating on the lower intensity mode, 10% of peak intensity, further reducing the impression of change. Details of the calculated intensity for each of the aviation lights from this location are provided in Appendix 16.1 (EIAR Volume 3).

The Proposed Development would occupy a small horizontal extent within the wider views and would appear in a part of the view which includes existing wind farms. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicate that visibility of the Proposed Development would be possible from much of the route, although this would generally be more restricted with fewer turbines visible than at the viewpoint location. The Proposed Development is judged to result in a small scale of change as a result of the introduction of further wind turbines along the distant skyline, moderated by the screening effect of topography and the presence of other wind energy development that is more prominent in the view.

Overall, the magnitude of effect is judged to be **Very Low**.

Significance of Effect

During construction there would be **no visual effect** at this location. During operation, the visual effect seen at this location is judged to be **Negligible (not significant)**.

Table 35 Effects on receptors at Newton Point, Arran

Viewpoint 22: Newton Point, Arran (see Figures VP22.1 to VP22.3, EIAR Volume 2d)

Baseline Description

This viewpoint is located at Newton Point, a low-lying coastal outcrop to the north of Lochranza. This is a specific viewpoint, recognised on OS mapping and is a point on the Arran Coastal Way. The focus of the view is seaward, towards the distant low profile of Kintyre. To the south, in the mid-ground of the view is the small settlement of Lochranza. Houses hug the narrow low-lying coastline which sits at the foot of steeply rising wooded hills and moorland. The expanse of the Kilbrannan Sound occupies the midground of the view.

The Deucheran Hill and Cour wind farms form two small but distinct clusters of turbines on the skyline of Kintyre to the south-west and Freasdail Wind Farm a further cluster visible to the north-west.

After dark, the lights of properties and the pier at Lochranza, and occasional car headlights on the A841 are visible, as are occasional lights on vessels at sea. Property lights and occasional car headlights along the western coast of Kintyre may be visible in certain conditions but would be distant and less noticeable.

Overall, the value of the view is judged to be **High**.

Visual Sensitivity

This representative viewpoint location is also within the North Arran NSA and receptors are likely to have a greater awareness of the landscape and views. Wind farms on Kintyre are an existing feature of the view. Taking this into account, susceptibility to change is judged to be **Medium**, and the sensitivity **High**.

Magnitude of Effect - Construction

Views of construction activities would be screened by intervening moorland topography and vegetation on Kintyre. **No change** within the Development Site would be visible from this location.

Viewpoint 22: Newton Point, Arran (see Figures VP22.1 to VP22.3, EIAR Volume 2d)

Magnitude of Effect – Operation

The blades of 6 proposed turbines would theoretically be visible, although given the distance of approximately 22 km would often be difficult to distinguish. The Proposed Development would be seen within the same part of the view, and behind the existing Deucheran Hill scheme. Size comparison between the two wind farms would be difficult over this distance, and given intervening screening features and, for most people, they would read as part of a single distant cluster of wind turbines.

An aviation light on 1 of the proposed turbines may be visible along the distant silhouette of the Kintyre peninsula. However, it is likely to be at least partially screened by intervening woodland and one of the existing Deucheran Hill turbines. Therefore, if visible, it would appear as a very minor and distant feature within a view that includes other existing and closer range light sources. As this location is greater than 5 km from the Proposed Development, when visible, the aviation lighting is likely to be operating on the lower intensity mode, 10% of peak intensity, further reducing the impression of change. Details of the calculated intensity for each of the aviation lights from this location are provided in Appendix 16.1 (EIAR Volume 3).

The Proposed Development would occupy a very small horizontal extent of the broad panorama and would generally be perceived as part of, or a small extension to, the existing Deucheran Hill Wind Farm. The geographic extent of similar views would include a small part of the Newton Point headland as far north as Rubha Creagan Dubha and parts of the Arran coast south from Catacol to Thundergay. The Proposed Development is judged to result in a small scale of change arising from the introduction of further vertical moving features along the distant skyline, moderated by the screening effect of topography and the presence of other wind energy development that is more prominent in the view.

Overall, the magnitude of effect is judged to be **Very Low**.

Significance of Effect

During construction there would be **no visual effect** at this location. During operation, the visual effect seen at this location is judged to be **Negligible (not significant)**.

Table 36 Effects on users of the A841 at Whitefarland

Viewpoint 23: A841, Whitefarland (see Figures VP23.1 to VP23.4, EIAR Volume 2d)

Baseline Description

Open, low-level panoramic view looking west across the broad expanse of the Kilbrannan Sound, towards the Kintyre peninsula. The view looks across pastoral grazing land which characterises the foreshore at this location. The Kilbrannan Sound defines the mid-ground and separates the view to the more distant uniform coastline of Kintyre. The undulating to rolling hills of Kintyre rise steeply from the coast, overlain by moorland and coniferous forestry. The settlement of Carradale can be seen to the south west from this location. Cour Wind Farm is a prominent feature along the skyline to the north-west. The hubs, blades, and some tower sections of the existing Beinn an Tuirc I and II and Deucheran Hill wind farms can also be seen breaking the skyline.

After dark, the distant lights of scattered properties on the Kintyre coast and settlement at Carradale would be visible across the Kilbrannan Sound. Property lights at Whitefarland and occasional car headlights on the A841 would also be seen in the foreground of views from this location.

On balance, the value of the view is judged to be **High**.

Visual Sensitivity

This view is representative of users of the A841 and Arran Coastal Way, from a section of the road within the North Arran NSA where receptors are likely to have a greater awareness of the landscape and views. Wind farms on Kintyre are a notable component of the view. Taking this into account, susceptibility to change is judged to be **Medium**, and the sensitivity **Medium**.

Magnitude of Effect - Construction

Views of construction activities would be screened by intervening moorland topography and vegetation on Kintyre. **No change** within the Development Site would be visible from this location.

Viewpoint 23: A841, Whitefarland (see Figures VP23.1 to VP23.4, EIAR Volume 2d)

Magnitude of Effect – Operation

The blades / blade tips of 5 proposed turbines and 1 hub would be visible, seen over a distance of approximately 13.5 km. The visible parts of the Proposed Development would appear as a relatively compact arrangement on the distant skyline. The array would be seen in close proximity to, but separated from, the Deucheran Hill Wind Farm. The screening effect of landform would make it difficult to appreciate the variation in turbine sizes. The Proposed Development would be less noticeable than the more prominent operational Deucheran Hill and Cour wind farms that are located closer to the eastern coast of Kintyre.

Aviation lighting on the hub of 1 turbine would be visible, seen as a distant red light along the silhouette of the Kintyre peninsula. As a result of the angle of view and the distance of over 13.5 km the light would appear as a minor and distant feature and would be of considerably lower intensity than car headlights and brake lights seen along the A841 from this location. As this location is greater than 5 km from the Proposed Development, when visible, the aviation lighting is likely to be operating on the lower intensity mode, 10% of peak intensity, further reducing the impression of change. Details of the calculated intensity for the aviation light potentially visible from this location are provided in Appendix 16.1 (EIAR Volume 3).

The horizontal extent of the proposed turbines within the view is small. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicate that similar views would be experienced from a short section of the Arran coast and A841 immediately north and south of this point. From other parts of the coast, including around Pirnmill and south from Dougarie Point to Brown Head, visibility would be more restricted and generally limited to a small number of blade tips, with no aviation lights visible. The Proposed Development is judged to result in a small scale of change as a result of the introduction of further vertical moving features along the distant skyline, moderated by the screening effect of topography, the presence of other wind energy development that is more prominent in the view, and that views of the proposed turbines would often be oblique or perpendicular to the direction of travel.

Overall, the magnitude of effect is judged to be **Very Low**.

Significance of Effect

During construction there would be **no visual effect** at this location. During operation, the visual effect seen at this location is judged to be **Negligible (not significant)**.

Table 37 Effects on receptors at Beinn Bharrain

Viewpoint 24: Beinn Bharrain (see Figures VP24.1 to VP24.5, EIAR Volume 2d)

Baseline Description

360° panoramic views are available from this elevated location atop Beinn Bharrain. Views east are dominated by the rugged hills of the Goat Fell range. To the south there are expansive view across Arran and the Firth of Clyde. To the north-west views include the uplands of the Knapdale peninsula. Views west look across the Kilbrannan Sound towards the relatively uniform coastline and interior of Kintyre. Islay and Jura form a very distant focus on the horizon to the east.

A number of operational wind farms are visible across the upland moorlands of Kintyre. To the south, the Tangy I and II, Beinn an Tuirc I and II and Auchadaduie wind farms appear as a single large cluster of turbines of varying size. Deucheran Hill comprises a small cluster of turbines within the central part of the peninsula. Cour Wind Farm is a prominent cluster on the east-facing upper slopes of Kintyre, with Freasdail Wind Farm appearing in successive views as an outlying cluster to the north of the peninsula.

After dark, the distant lights of scattered properties on the Kintyre coast and settlement at Carradale would be visible across the Kilbrannan Sound, as would occasional lights of cars and vessels at sea. Lights in settlement along the Arran cost, and in clear visibility on the Ayrshire coast would also be visible, but distant. Albeit possible, there are unlikely to be receptors at this location during darkness hours.

Overall, the value of the view is judged to be **High**.

Visual Sensitivity

This viewpoint is within the North Arran NSA and receptors at this location would be here to enjoy the 360° panoramic views. Views towards Kintyre include a number of notable existing wind farms. Receptors at this location are assessed as having **Medium** susceptibility to change of the type proposed, resulting in a **Medium** sensitivity.

Magnitude of Effect - Construction

Views of construction activities would be restricted by intervening moorland topography and vegetation on Kintyre. **No change** within the Development Site would be visible from this location.

Viewpoint 24: Beinn Bharrain (see Figures VP24.1 to VP24.5, EIAR Volume 2d)

Magnitude of Effect – Operation

The hubs and blades of 12 proposed turbines would be visible, seen at a distance of over 16 km. The array would appear as a relatively evenly spaced cluster of turbines, similar to the pattern of other wind farms in central and northern Kintyre. A large proportion of the towers of most turbines would be screened by intervening landform reducing the apparent height and scale of the Proposed Development. A series of other clusters and groups of turbines are apparent on Kintyre and the Proposed Development would add a further distant and clearly separate cluster of turbines.

Aviation lighting on 8 turbines would be visible from this location, seen as a distant and relatively evenly spread array of red lights below the horizon to the north-west. Night-time photomontages are provided in Figures VP24.5 and VP24.6 (EIAR Volume 2d) to give an impression of the lighting relative to other existing light sources in the view. It is important to note that these give an impression of how the lighting would appear within a photograph. In reality the lights would appear as a consistent red colour to the naked eye, without the brighter central glow. The aviation lights would introduce a new feature into the predominantly dark views experienced at this location. However, this would be moderated by distance and in most conditions when the lights are visible, they would be operating on the lower intensity mode, as indicated on Figure VP24.6 (EIAR Volume 2d). Details of the calculated intensity for each of the aviation lights from this location are provided in Appendix 16.1 (EIAR Volume 3). The likelihood of people being at this location at night is low and therefore the change described would be experienced by very few people.

The horizontal extent of the view occupied by the Proposed Development would be small and away from the distant focus of Islay and Jura. Operational wind farms are visible further to the north and south of Kintyre, thus the Proposed Development would not increase the extent of wind energy in the view. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicates that the geographic extent of similar views would be limited to the western summit of Beinn Bharrain, and nearby rounded western hills of Arran. The number and proportion of turbines and hub, and therefore aviation lights, quickly reduces away from the hilltops and higher elevations. The scale of the change is considered to be medium as a result of the introduction of further vertical moving features to the distant uplands of Kintyre, moderated by the separating effect of the Kilbrannan Sound and intervening topography, and taking into consideration the influence of existing operational wind energy development on Kintyre.

Overall, the magnitude of effect is judged to be **Low**.

Significance of Effect

During construction there would be **no visual effect** at this location. During operation, the visual effect seen at this location is judged to be **Minor (not significant)**.

Table 38 Effects on receptors at Goatfell, Arran

Viewpoint 25: Goatfell, Arran (see Figures VP25.1 to VP25.3, EIAR Volume 2d)

Baseline Description

This viewpoint is located at the summit of Goatfell, the highest peak on Arran at approximately 874m AOD. This is a popular destination with hillwalkers. The two most recognised routes to the summit are from Brodick Castle to the south-east, or from Corrie to the east.

360° panoramic views are available from the summit. To the west is the dramatic, elevated granite ridgeline that encircles the peak, beyond which lies the more rounded western hills of Arran. In the far distance is the thin band of sea that separates the mainland and Southern Hebrides. The dramatic conical profile of the Paps of Jura is seen on the far horizon. The low profile of the Kintyre peninsula is seen in small sections between the intervening landform on Arran. To the north the mountainous topography falls away to open views across the Sound of Bute and towards the Isle of Bute, Cowal and distant Ayrshire coast. Views south and east are dominated by the expanse of the Firth of Clyde, which separates Arran and the coastline of Ayrshire. Though small and distant, the Tangy I and II, Auchadaduie, and Beinn an Tuirc I and II schemes are visible clusters of turbines on Kintyre. Freasdail Wind Farm appears outlying to the north-west, partially screened by intervening landform. A number of other wind farms on Knapdale and Cowal to the north and Ayrshire to the east area also visible.

After dark, the lights of settlements along the coast of Arran, and particularly Brodick to the south and the distant lights on the mainland Ayrshire coast, Isle of Bute, Cowal and southern Kintyre are visible, as are occasional lights on vessels at sea. Albeit possible, there are unlikely to be receptors at this location during darkness hours.

Overall, the value of the view is judged to be **High**.

Visual Sensitivity

This is a popular location within the North Arran NSA and receptors are likely to have a greater awareness of the landscape and views. Wind farms on Kintyre and other areas are small and distant components of the panoramic view. Taking this into account, susceptibility to change is judged to be **Medium**, and the sensitivity **High**.

Magnitude of Effect - Construction

Views of construction activities would be restricted by intervening moorland topography and vegetation on Kintyre. **No change** within the Development Site would be perceptible from this location.

Viewpoint 25: Goatfell, Arran (see Figures VP25.1 to VP25.3, EIAR Volume 2d)

Magnitude of Effect – Operation

The hubs and blades of 12 proposed turbines would be visible, seen over a distance of approximately 26 km. A large proportion of the towers of most turbines would be screened by intervening landform reducing the apparent height and scale of the Proposed Development. A series of other wind farms are apparent on Kintyre and the Proposed Development would add a further distant and clearly separate development within this existing pattern.

Aviation lighting on 8 turbines would theoretically be visible. Given the distance of over 26 km it is likely that weather and atmospheric conditions would limit visibility of the lighting. When visible the lighting is likely to be a minor feature, appreciated as part of a variety of distant light sources seen in the background of the panoramic views available from this high point.

The Proposed Development would occupy a very small horizontal extent of the view. The ZTVs (Figures 7.6 and 7.7, EIAR Volume 2c) indicate that the geographic extent of similar views would be limited to very isolated locations on the high ridges and summits of the Arran mountains. The scale of change is judged to be very small as a result of the intervening distance, the small part of the 360°-degree views affected and the context of existing operational wind farms.

Overall, the magnitude of effect is judged to be **Very Low**.

Significance of Effect

During construction there would be **no visual effect** at this location. During operation, the visual effect is judged to be **Negligible (not significant)**.

1.5 Cumulative Landscape Effects

1.5.1 A detailed assessment of potential cumulative effects on the special landscape qualities of the North Arran NSA is provided in Appendix 7.3 (EIAR Volume 3) and on the attributes of the North Aran WLA is provided in Appendix 7.3 (EIAR Volume 3). The following tables provide an assessment of cumulative effects on the remaining landscape receptors included within the cumulative assessment.

Table 39 Cumulative Effects on West Kintyre APQ

Receptor: West Kintyre APQ

Scenario 1 (existing, consented and under construction schemes)

The majority of the cumulative schemes (with the exception of short sections of access tracks to Beinn an Tuirc (I – III) and Deucheran) are outside of the West Kintyre APQ and therefore the cumulative baseline is generally one of indirect change.

The cumulative ZTV (Figure 7.13, EIAR Volume 2c) shows extensive visibility of cumulative wind farms from the West Kintyre APQ. This is largely as a result of the Gigha and Leim Farm turbines located on the Isle of Gigha, but also includes more localised visibility of many of the other cumulative schemes. In general, visibility of cumulative schemes is limited to tops of turbines. However, there are also areas where wind farms locally influence the perception of this landscape, most notably Auchadaduie, Blary Hill and Tangy IV on the area around and south of Glenbarr, and Cour, High Constellation, Freasdail and Eascairt on the area around Dun Skeig.

The proposed turbines would be located inland from the APQ, within the interior uplands of Kintyre. A small part of the access track and junction with the A83 would be located within the APQ, resulting in very localised direct change.

As indicated by the ZTV, the geographic extent of potential indirect change resulting from the Proposed Development would be limited. The cumulative ZTV (Figure 7.13, EIAR Volume 2c) further indicates that the Proposed Development would not add any new areas of visibility of wind farms from the APQ. The magnitude of cumulative change resulting would be **Low**, with the majority of the APQ unaffected. The cumulative level of effect in this Scenario is judged to be **Minor (not significant)**.

Scenario 2 (existing, consented, under construction and application stage schemes)

This scenario sees the addition of Sheirdrim and Narachan into the baseline. Sheirdrim is likely to appear to link with Freasdail and Eascairt wind farms, increasing the influence of wind farms on the northern part of the APQ at Dun Skeig, with more limited influence further south due to the separating distances involved.

A small part of the Narachan access junction with the A83 would be located within the APQ, resulting in a localised geographic extent of change. There would be additional direct cumulative change resulting from short section of access track of the Proposed Development, slightly increasing the influence of wind energy development construction.

As with Scenario 1, indirect change, in the form of visibility, resulting from the Proposed Development would be limited to a relatively small area, with the majority of the APQ unaffected. Considering the APQ as a whole, the Proposed Development would generally be visible over a lesser extent than many of the cumulative schemes.

The magnitude of cumulative change resulting would be **Low**, with the majority of the APQ unaffected. The cumulative level of effect in this Scenario is judged to be **Minor (not significant)**.

Table 40 Cumulative Effects on Upland Forest Moor Mosaic LCT

Receptor: Upland Forest Moor Mosaic LCT (ABLWECS (2017) LCT 6b)

Scenario 1 (existing, consented and under construction schemes)

The majority of the cumulative schemes (with the exception of Gigha and Leim Farm) are within this LCT and as such are an existing characteristic of this landscape, such that it is considered to be a 'landscape with wind farms'. The addition of the approved Beinn an Tuirc III and Blary Hill may lead to a localised wind farm landscape in the south of the LCT, within which wind farms would be a dominant feature. Eascairt is located further north, slightly south of the operational Freasdail scheme, reinforcing the influence of wind farms on this landscape. The cumulative ZTV (Figure 7.13, EIAR Volume 2c) shows extensive visibility of these schemes.

The Proposed Development would introduce an additional wind farm into this LCT, locally increasing the prominence of wind farms within the site and immediate context. Careful siting and design make use of landform to restrict the extent of potential indirect change on this LCT. This is evidenced by the cumulative ZTV (Figure 7.13, EIAR Volume 2c) which demonstrates the limited extent of visibility of the Proposed Development from much of this LCT and therefore the limited contribution to the overall impression of wind farms within this landscape.

The location of the Proposed Development is such that it is sufficiently separated from the cumulative schemes to appear as a distinct cluster of wind turbines. This is consistent with existing wind farm development in Kintyre, which is focussed within the Upland Forest Moor Mosaic LCT. Wind farms within the LCT are located both along the interior (Beinn an Tuirc (I and II) and Deucheran Hill wind farms) and closer to the edge of the LCT (Tangy IV, Auchadaduie, Blary Hill, most of Beinn an Tuirc III, Cour, High Constellation, Freasdail ,and Eascairt wind farms); such that there is no discernible pattern when viewed on the ground; although Barr Glen is an important separating landform between groups of turbines within the central and southern parts of the peninsula, dividing the Proposed Development from the localised wind farm landscape to the south.

Wind farms are an existing characteristic of this landscape. The addition of the Proposed Development would result in a local intensification of a 'landscape with wind farms' character but would not result in the character of this LCT becoming dominated by wind farms (i.e. becoming a 'wind farm landscape'). Overall, the Proposed Development would add to the appearance of wind farms within this landscape but would not result in noticeable change to key characteristics.

The cumulative magnitude of change in relation to cumulative Scenario 1 would be locally **Medium** within the Development Site and immediate context (within 2 km), where the Proposed Development would increase the contribution that wind turbines make as a feature in the landscape. Taking account of the low sensitivity and locally medium magnitude of additional change, the significance of cumulative effect would be **locally Moderate (significant)** within the Development Site and immediate context. However, when considering the wider extent of this LCT the magnitude of additional change in relation to cumulative Scenario 1 would be Low, resulting in a **Minor (not significant)** effect.

Receptor: Upland Forest Moor Mosaic LCT (ABLWECS (2017) LCT 6b)

Scenario 2 (existing, consented, under construction and application stage schemes)

The cumulative baseline in Scenario 2 involves the addition of the Narachan and Sheirdrim wind farms to this LCT.

Narachan is located in close proximity to the grouping formed by High Constellation and Cour, with slight separation from Deucheran Hill to the south, and as such would lead to the local intensification of wind farms in this part of the LCT and potentially resulting in the impression of a localised 'wind farm landscape' between these schemes. The Narachan scheme also includes visible medium intensity red aviation lighting, therefore introducing an additional feature into the night-time cumulative baseline. Sheirdrim Wind Farm would effectively fill the separating space between the Eascairt and Freasdail wind farms, and extend it further west; thus, potentially forming one large cluster of turbines to the north of Kintyre.

The cumulative ZTV (Figure 7.14, EIAR Volume 2d) indicates that the baseline of cumulative Scenario 2 would be one of increased visibility of wind farms in comparison to Scenario 1. The additional increase in the geographic extent of visibility resulting from the Proposed Development would generally be from very localised areas, thus would be very small.

In this Scenario, the Proposed Development would be located approximately 3 km to the south of the large grouping of Narachan, Cour and High Constellation, and also separated from Deucheran Hill to the east; as a result, the Proposed Development would appear as a distinct cluster of wind turbines. The addition of the Proposed Development would, however, result in the further intensification of wind farms within this central part of the LCT. Beyond this local area, potential change resulting from the addition of the proposed turbines on the wider extent of the LCT would be limited, as evidenced by the cumulative ZTV.

The cumulative lighting ZTV (Figure 7.15, EIAR Volume 2c) indicates relatively extensive areas of theoretical visibility of the lights on Narachan within the central/northern part of this LCT, with more limited and fragmented visibility in other parts of the LCT. The addition of the Proposed Development would result in a localised increase in the influence of aviation lighting within the central parts of this LCT. The ZTV somewhat overstates visibility of the lighting as in reality large areas of commercial forestry are present, limiting outward views. In addition, as a result of the angle of view the apparent intensity of the proposed aviation lights would be reduced when seen from the area immediately surrounding the Proposed Development, as indicated by the lighting intensity ZTV (Figure 7.9, EIAR Volume 2c), reducing the impression of change.

As with Scenario 1, the cumulative magnitude of change resulting from the addition of the Proposed Development into cumulative Scenario 2 would be **locally Medium** within the Development Site and its immediate context. The level of cumulative effects in Scenario 2 would be **locally Moderate (significant)** within the immediate vicinity (up to approximately 2 km) of the Proposed Development where experienced in combination with Deucheran Hill. With reference to the wider extent of this LCT, the magnitude of additional change would be **Low**, and the level of effect **Minor (not significant)**.

Table 41 Cumulative Effects on Coastal Plain LCT

Receptor: Coastal Plain LCT (ABLWECS (2017) LCT 19)

Scenario 1 (existing, consented and under construction schemes)

The most notable cumulative schemes visible from this coastal LCT are Gigha and Leim Farm to the west, and the distant Airigh Wind Farm on the Knapdale peninsula to the north. However, the small-scale nature and the clear separation provided by the Sound of Gigha results in little influence on the character of this LCT. Similarly, the limited nature of visibility of both Auchadaduie and Tangy IV from this LCT would add little to a cumulative baseline.

The Proposed Development would predominantly be located inland from this LCT, within the interior uplands of Kintyre. The exception is that a small section of the access junction with the A83 would be located within this LCT, resulting in very localised direct change, reducing over time. No other wind farm access tracks would be within this LCT, such that this element in itself would not result in a cumulative effect.

The cumulative magnitude of change would be **Low** as a result of: the very limited geographic extent of potential additional change, as indicated by the cumulative ZTV (Figure 7.13, EIAR Volume 2c); limited perception of the Proposed Development from within this LCT; and a clear distinction between this coastal landscape and the upland moorland landscape within which the majority of the Proposed Development would be located. The cumulative level of effect in this Scenario is judged to be **Minor (not significant)**.

Scenario 2 (existing, consented, under construction and application stage schemes)

The cumulative baseline of this scenario includes the addition of a small part of the Narachan access junction with the A83. The ZTV (Figure 7.14, EIAR Volume 2c) indicates limited visibility of blade tips of the Narachan turbines from isolated parts of this LCT such as the tip of Rhunahaorine Point and the Tayinloan ferry terminal, and as such would have limited influence on this landscape. As there is little difference to the cumulative baseline in comparison to that of Scenario 1, the nature and scale of cumulative change resulting from the addition of the Proposed Development would also be similar and as such is judged to remain **Minor (not significant)** for Scenario 2.

Table 42 Cumulative Effects on Rocky Mosaic LCT

Receptor: Rocky Mosaic LCT (ABLWECS (2017) LCT 20)

Scenario 1 (existing, consented and under construction schemes)

The majority of the cumulative schemes (with the exception of short sections of access tracks to Beinn an Tuirc (I – III), Deucheran, Freasdail, High Constellation, Eascairt and Cour) are located outside this LCT and therefore the cumulative baseline is generally one of indirect change.

Most areas of this LCT are subject to indirect change, in the form of visibility, from at least one of the cumulative schemes. In general, visibility of cumulative schemes is limited to tops of turbines. However, there are also areas where wind farms locally influence the perception of this landscape, most notably Auchadaduie, Blary Hill and Tangy IV on western Kintyre; Cour and Eascairt on parts of the east Kintyre area, and Freasdail on parts of west Kintyre and Knapdale areas. In addition, Deucheran, Beinn an Tuirc (I-III), Gigha and Leim Farm add to the overall impression of wind farms from parts of this LCT.

The Proposed Development would be located within relative close proximity to this LCT, although largely separated from it by intervening landform along the edge of the uplands. A short section of access track would be located within this LCT resulting in direct change, although this would be limited to localised upgrades of an existing access to Deucheran Hill Wind Farm and forestry haul road.

With respect to the cumulative ZTV (Figure 7.13, EIAR Volume 2c), the Proposed Development would result in a small geographic extent of additional visibility of wind farms, potentially resulting in a localised increase in the perception and influence of wind farms within this LCT. Beyond this limited area, the Proposed Development would result in little or no perceptible change to the character of this LCT and as such the cumulative magnitude of change is anticipated to be **Low**. The cumulative level of effect is in this Scenario is judged to be **Minor (not significant)**.

Scenario 2 (existing, consented, under construction and application stage schemes)

The cumulative baseline of this scenario includes two additional wind farms, Narachan and Sheirdrim. Part of the access track to both of these cumulative schemes would be located within this LCT, with potential for localised direct change. As in Scenario 1, the Proposed Development would result in localised direct change, slightly increasing the influence of wind energy development construction.

The ZTV (Figure 7.14, EIAR Volume 2c) indicates very limited theoretical visibility from within this LCT and as such it offers little additional indirect change. Where the Proposed Development would be visible from this LCT it would generally appear as a distinct cluster that would have a visual relationship to other distant clusters of wind turbines and would result in a limited and localised perception of additional change to the character of this LCT.

The cumulative magnitude of change is anticipated to be **Low**. The cumulative level of effect in this Scenario is judged to be **Minor (not significant)**.

1.6 Cumulative Visual Effects

1.6.1 The following tables provide an assessment of potential effects on each of the visual receptors based on the identified representative viewpoint locations. Visualisations from each of the viewpoint locations are provided in EIAR Volume 2d.

Table 43 Cumulative Effects on receptors at Craighouse, Jura

Viewpoint 1: Craighouse, Jura (see Figures VP1.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

The majority of the identified cumulative wind farms would be visible along the length of the Kintyre peninsula from this location. The addition of the Proposed Development would increase the number of turbines within the group formed by Beinn an Tuirc I-III and Blary Hill. It is unlikely that most observers would be able to notice the Proposed Development in isolation or perceive the minor change to a segment of the view containing a number of existing turbines. It would be difficult to distinguish the Proposed Development from the existing wind turbines and as such it would not result in a discernible change.

The magnitude of cumulative change resulting is judged to be **Very Low**. The cumulative level of effect in this scenario is judged to be **Negligible (not significant)**.

Scenario 2 (existing, consented, under construction and application stage schemes)

The proposed Sheirdrim and Narachan wind farms would further add to the large groupings of wind turbines to the north of Kintyre, reinforcing the pattern of development apparent in Scenario 1. Aviation lighting on the Narachan turbines would be theoretically visible in certain conditions, distant from this location. The addition of the Proposed Development aviation lighting would introduce a smaller cluster of faint red lighting along the distant silhouette of Kintyre, resulting in a small but perceptible increase in background light sources.

Amongst the other cumulative schemes in this Scenario, the change attributable to the addition of the Proposed Development would be **Very Low** and the level of cumulative effect **Negligible (not significant)**.

Table 44 Cumulative Effects on users of the B8024 south of Kilberry

Viewpoint 2: B8024 south of Kilberry (see Figures VP2.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

A number of the identified cumulative wind farms would be visible along the length of the Kintyre peninsula as a series of relatively evenly spaced clusters set beyond the ridgeline of the peninsula. The Proposed Development would be an additional cluster of wind turbines on the distant skyline, between the Deucheran Hill scheme and more distant group formed by the Auchadaduie and Tangy IV wind farms. While the Proposed Development would increase the perception of wind farms on Kintyre from this location, it would not result in an increase in the overall prominence of wind farms such that they would become a dominant feature of the view.

The magnitude of cumulative change resulting is therefore judged to be **Low**. The cumulative level of effect in this scenario is judged to be **Minor (not significant)**.

Viewpoint 2: B8024 south of Kilberry (see Figures VP2.2, EIAR Volume 2d)

Scenario 2 (existing, consented, under construction and application stage schemes)

This scenario sees the introduction of the Narachan wind farm into the cumulative baseline. Narachan would appear to the north of Kintyre, closer to this viewpoint, forming a large grouping of wind turbines together with Deucheran Hill. The medium intensity nacelle aviation lights on up to 14 of the Narachan turbines would potentially be visible from this location.

In this scenario the Proposed Development would occupy a smaller horizontal extent than the Narachan and Deucheran Hill cluster, would be more distant from this location, and the proposed turbines would appear approximately equal in size to those of Narachan.

Aviation lights on 8 of the proposed turbines would be visible at this location. The addition of these features would be seen as a separate and more compact cluster of red lights. They would be more distant than those of Narachan and when visible would generally appear as a minor feature but would increase the horizontal extent and influence of distant light sources within the view.

Overall, the scale of change would be similar to that experienced in Scenario 1, with the magnitude of cumulative change still within the **Low** threshold. The cumulative level of effect in this scenario is therefore judged to be **Minor (not significant)**.

Table 45 Cumulative Effects on receptors at Ardpatrick

Viewpoint 3: Ardpatrick (see Figures VP3.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

In this scenario the cumulative baseline is largely the same as the existing situation, with the exception of several blade tips of the High Constellation and Blary Hill schemes which would have limited influence on this view.

The addition of the Proposed Development would result in an increase in the appearance and extent of wind turbines within upland Kintyre further to the south of the peninsula, in a part of the view where it would be seen in combination with the Gigha and Leim turbines. Due to the limited visibility and intervening distance, the Proposed Development would result in a small increase in the perception of wind turbines in this view.

The magnitude of cumulative change resulting is therefore judged to be **Low**. The cumulative level of effect in this scenario is judged to be **Minor (not significant)**.

Scenario 2 (existing, consented, under construction and application stage schemes)

The addition of Sheirdrim and Narachan would result in an increase in the visibility of wind energy on Kintyre. Sheirdrim would be prominent in views east to the skyline of Kintyre. Narachan would be largely screened by the intervening ridgeline of the peninsula.

The Development would appear in a similar part of the view as Narachan. It would also be largely screened such that only the blade tips of turbines would be apparent. The proposed turbines would add to a series of partially screened wind turbine clusters seen along the far Kintyre skyline. The addition of the Proposed Development to this baseline scenario would not result in any greater additional effect than that for Scenario 1.

The magnitude of cumulative change would be **Low** and the cumulative level of effect in this scenario is judged to be **Minor (not significant)**.

Table 46 Cumulative Effects on users of the A83 north of Clachan

Viewpoint 4: A83 north of Clachan (see Figures VP4.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

In this scenario the Cour and High Constellation cumulative schemes would appear as one grouping of wind turbines on the distant skyline, closest to this viewpoint. Deucheran Hill would appear as both a smaller scale and more distant wind energy development amid the uplands of Kintyre.

The Proposed Development would be seen in combination with the identified cumulative schemes and would introduce a further wind farm into the view along the Kintyre peninsula, and would increase the extent of wind energy development slightly further to the west within this view. The Proposed Development would be sited beyond intervening landform in a similar manner to the appearance of other wind energy in the view. Taking into account the intervening distance of c.15.5 km, the proposed turbines would result in perceptible additional change but would not noticeably increase the overall prominence of wind farms.

The magnitude of cumulative change is judged to be **Low**. The cumulative level of effect in this scenario is judged to be **Minor (not significant)**.

Scenario 2 (existing, consented, under construction and application stage schemes)

This scenario sees the introduction of the Narachan and Sheirdrim wind farms into the cumulative baseline. The medium intensity aviation lighting on 13 of the 17 Narachan turbines would be visible from this location.

Sheirdrim would extend the Freasdail and Eascairt clusters, forming a large grouping of turbines and bringing them closer to this location. Narachan would be visible directly in front of the Deucheran Hill scheme, increasing its horizontal extent, and clearly larger and more prominent along the distant skyline. The medium intensity aviation lighting on up to 15 of the Narachan turbines would potentially be visible from this location.

The Proposed Development would add a further cluster of wind turbines into the uplands of Kintyre, though it would be smaller in extent and size than cumulative schemes seen in combination and succession. In this scenario the cumulative effect attributable to the Proposed Development would diminish as a result of the cumulative baseline increasing the prominence of wind energy in the view.

Aviation lights on 1 of the proposed turbines would be visible from this location, slightly extending the horizontal extent of the view containing red lights. The light on the Proposed Development would be more distant and lower on the horizon than those of Narachan and when visible would appear as a minor feature in a glimpsed view.

The magnitude of cumulative change is still judged to be within the **Low** threshold. The cumulative level of effect in this scenario is therefore judged to be **Minor (not significant)**.

Sequential Effects

This viewpoint is one of the only locations on the A83 travelling south from where the Proposed Development would be visible. The cumulative ZTV (Figure 7.14, EIAR Volume 2c) indicates that the Proposed Development would not add visibility of wind farms to any additional sections of the route in both Scenarios 1 and 2. Cumulative effects on the wider southbound A83 would therefore be very limited, and less than that experienced from the viewpoint location. Northbound views from the A83 are discussed under Viewpoint 17 and 20, below.

Table 47 Cumulative Effects on receptors at Dun Skeig

Viewpoint 5: Dun Skeig (see Figures VP5.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

In this scenario the Freasdail and Eascairt schemes would be visible to the north of Kintyre, seen beyond intervening topography. Cour and High Constellation cumulative schemes would appear as one uneven grouping of wind turbines further to the south. Fleeting blade tips of Deucheran Hill are barely discernible and contribute little to the baseline scenario. Airigh would appear as an outlying cluster across West Loch Tarbert to the north.

The Proposed Development would be seen in combination with several of the identified cumulative schemes, would introduce a further wind farm into the view along the Kintyre peninsula, and would increase the extent of wind energy development slightly further to the west within this view. The Proposed Development would be sited beyond intervening landform in a similar manner to the appearance of other wind farms in the view. As a result of distance, the limited visibility of the Proposed Development, and taking into consideration the greater prominence of cumulative schemes seen in combination and succession, the proposed turbines would not noticeably increase the overall prominence of wind farms. The magnitude of cumulative change is judged to be **Low**. The cumulative level of effect in this scenario is judged to be **Minor (not significant)**.

Scenario 2 (existing, consented, under construction and application stage schemes)

This scenario sees the introduction of the Narachan and Sheirdrim wind farms into the cumulative baseline. Sheirdrim would extend the Freasdail and Eascairt clusters, forming a large grouping of turbines to the east, closest to this location. Narachan would be visible as a separate cluster further south on Kintyre. The medium intensity aviation lighting on 8 of the Narachan turbines would be visible from this location.

The Proposed Development would add a further cluster of wind turbines into the uplands of Kintyre, though it would be smaller in extent and size than cumulative schemes seen in combination and succession. In this scenario the cumulative effect attributable to the Proposed Development would diminish as a result of the cumulative baseline increasing the prominence of wind energy in the view.

Aviation lights on 3 of the proposed turbines would be visible at this location, seen as a separate group of red lights, along the silhouette of Kintyre. They would be more distant than those of Narachan and appear as a minor additional feature but would slightly increase the horizontal extent and influence of light sources within the view.

The magnitude of cumulative change is still judged to be within the **Low** threshold. The cumulative level of effect in this scenario is therefore judged to be **Minor (not significant)**.

Table 48 Cumulative Effects on passengers of the Kennacraig to Port Askaig Ferry

Viewpoint 6: Kennacraig – Port Askaig Ferry (Figure VP6.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

The majority of the identified cumulative wind farms would be visible along the length of the Kintyre peninsula from this location. Eascairt and Freasdail wind farms would be seen as compact clusters to the north-east. High Constellation and Cour are likely to be perceived as a single large grouping of blades within the northern part of the peninsula. The fleeting blade tips of Deucheran Hill are visible in the centre of Kintyre. Blade tips of the Beinn an Tuirc (I-III) and Blary Hill schemes would be perceived as a single large grouping of turbines set back in the uplands of Kintyre. The Auchadaduie and Tangy IV schemes form a distant cluster to the far south of Kintyre. Airigh Wind Farm would be seen as an outlying cluster to the north-east. Although theoretically visible, the turbine at Leim Farm is largely screened by landform and as such contributes little to the cumulative baseline.

The addition of the Proposed Development to this scenario would add to the influence of wind energy within the central parts of Kintyre. The Proposed Development would be partially screened by topography but would cover a larger extent and appear more prominent than other schemes on Kintyre from this location. From other parts of the journey other wind farms, most notably Freasdail would appear more prominent. The Proposed Development would be located in part of the view in which other cumulative wind farms are present and therefore would not increase the extent of the view affected. As demonstrated by the cumulative ZTV (Figure 7.13, EIAR Volume 2c) the Proposed Development would not result in wind farms being visible from a greater extent of the journey, and in this respect would be less visible than other schemes.

The Proposed Development would result in an increased perception of wind farms on Kintyre from part of the journey but would be seen within a part of the view already influenced by wind farms, appreciated as part of a journey with a variety of sequential views which tend to draw the focus to more dramatic scenery to the north and west. The scale of change is judged to be low as a consequence of the intervening distance, the small extent of view affected and that the focus of views would tend to be elsewhere. The magnitude of cumulative change is judged to be **Low**. The cumulative level of effect in this scenario is judged to be **Minor (not significant)**.

Viewpoint 6: Kennacraig – Port Askaig Ferry (Figure VP6.2, EIAR Volume 2d)

Scenario 2 (existing, consented, under construction and application stage schemes)

This scenario sees the introduction of the Narachan and Sheirdrim wind farms into the cumulative baseline. Sheirdrim would extend the Freasdail and Eascairt clusters, forming a large grouping of turbines to the east, closest to this location. Narachan would effectively fill the space between Deucheran Hill and the cluster formed by High Constellation and Cour, creating a single extensive grouping. The medium intensity aviation lighting on 10 of the Narachan turbines would be visible from this location.

The Proposed Development would create an additional grouping within the uplands of Kintyre, though it would be smaller in extent than other cumulative schemes seen in combination and succession. In this scenario the cumulative effect attributable to the Proposed Development would diminish as a result of the cumulative baseline increasing the prominence of wind energy in the view.

Aviation lights on 8 of the proposed turbines would be visible from this location. The addition of these features would be seen as a separate and relatively even array of red lights, to the south of those at Narachan. They would be more distant than of the lights on Narachan but would slightly increase the horizontal extent and influence of light sources within the view. The experience of distant light sources would be influenced by both internal and external lighting on the ferry from this location.

The magnitude of cumulative change is judged to be within the **Low** threshold. The cumulative level of effect in this scenario is judged to be **Minor (not significant)**.

Table 49 Cumulative Effects on passengers of the Kennacraig to Port Ellen Ferry

Viewpoint 7: Kennacraig - Port Ellen Ferry (see Figures VP7.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

The majority of the identified cumulative wind farms would be visible along the length of the Kintyre from this location. Airigh Wind Farm would be seen as an outlying cluster to the north on Knapdale. Tangy IV, and Beinn an Tuirc I-III, Auchadaduie and Blary Hill, form two large groupings of wind turbines to the south of the peninsula. To the north of Kintyre, clusters of turbines are seen as a series of compact arrays partially screened by intervening landform.

The addition of the Proposed Development to this scenario would add to the influence of wind energy within the central parts of Kintyre. It would appear similar, or smaller in extent than the groupings to the south, but generally larger than those further north. The Proposed Development would appear closer and therefore slightly more prominent than other wind farms from this part of the journey, although would still be seen as a distant feature occupying a small part of the overall view. Views towards Kintyre from the ferry already include a number of turbines and the Proposed Development would not result in an increase in the extent of the view affected, or the length of the journey from which wind farms are visible. Therefore, while the Proposed Development adds to the impression of wind farms within views east it would not have a strong influence of the overall experience of views or detract from the existing focus which tends towards the dramatic scenery to the north and west.

The magnitude of cumulative change is judged to be **Low**. The cumulative level of effect in this scenario is judged to be **Minor (not significant)**.

Viewpoint 7: Kennacraig - Port Ellen Ferry (see Figures VP7.2, EIAR Volume 2d)

Scenario 2 (existing, consented, under construction and application stage schemes)

This scenario sees the introduction of the Narachan and Sheirdrim wind farms into the cumulative baseline. Sheirdrim would extend the Freasdail and Eascairt clusters, forming a large grouping of turbines to the north of Kintyre. Narachan would enlarge the group of turbines formed by High Constellation and Cour schemes within the centre of the peninsula, seen in front of the distant landform or Arran beyond. The medium intensity aviation lighting on 13 of the Narachan turbines would be visible from this location.

The addition of the Proposed Development to this scenario would add to the influence of wind energy within the central parts of Kintyre. It would be smaller in extent than the large groupings to the north and south that would be seen in-combination. In this scenario the cumulative effect attributable to the Proposed Development would diminish as a result of the cumulative baseline increasing the prominence of wind energy in the view.

Aviation lights on 8 of the proposed turbines would be visible at this location. The addition of these features would be seen as a separate and relatively even array of red lights, to the south of those at Narachan. When visible the lights on both schemes would appear as distant elements, with the Proposed Development being slightly closer to this location and slightly extending the horizontal extent and influence of light sources within the view. The experience of distant light sources would be influenced by both internal and external lighting on the ferry from this location.

In this scenario, the magnitude of cumulative change is considered to be similar to that of Scenario 1, and as such within the **Low** threshold. The cumulative level of effect in this scenario is therefore judged to be **Minor (not significant)**.

Table 50 Cumulative Effects on receptors at Ardminish, Gigha

Viewpoint 8: Ardminish, Gigha (see Figures VP8.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

A number of the identified cumulative wind farms would be visible along the length of the Kintyre from this location. Airigh Wind Farm is theoretically visible to the north-east but would be largely screened by intervening vegetation from this location, with greater visibility from other parts of Gigha. A small number of blade tips of the Freasdail and Deucheran Hill schemes are theoretically visible but contribute little to the cumulative baseline from the viewpoint location, although are more visible from other parts of Gigha. Several blades of the High Constellation Wind Farm would be visible in central parts of Kintyre. The Beinn an Tuirc (I-III) and Blary Hill schemes are visible as one large notable group of varying turbines, with Auchadaduie slightly outlying at its western extent. The Tangy IV scheme forms a cluster further to the south along Kintyre. Although theoretically visible, the turbines at Leim Farm and Gigha are screened by buildings and woodland from the viewpoint locations but are more visible from other parts of Gigha.

The addition of the Proposed Development to this scenario would add to the influence of wind energy within the central parts of Kintyre. Within the view the Proposed Development would extend the influence of the Beinn an Tuirc (I-III), Blary Hill and Auchadaduie group northwards along the peninsula, although would be perceived as a separate development within the upland interior of Kintyre.

The Proposed Development would be in closer proximity to the other visible schemes and would result in a noticeable additional change. The magnitude of cumulative change is judged to be **Medium**. The cumulative level of effect in this scenario is judged to be **Moderate (significant)**.

Viewpoint 8: Ardminish, Gigha (see Figures VP8.2, EIAR Volume 2d)

Scenario 2 (existing, consented, under construction and application stage schemes)

This scenario sees the introduction of the Narachan and Sheirdrim wind farms into the cumulative baseline. Sheirdrim would be visible as a further cluster of wind turbines in the distance to the north-east. Narachan would appear adjacent to High Constellation in the view, extending the influence of wind farms further south, and at night would introduce 7 medium intensity aviation lights along the outline of Kintyre.

The Proposed Development would add to the number of turbines within this segment of the view. The proposed turbines would sit inland, beyond the ridgeline of Kintyre in a manner similar to those at Beinn an Tuirc I-III, Blary Hill, High Constellation, and Narachan.

In this scenario the Proposed Development would reduce the separation between the Beinn an Tuirc I-III, Blary Hill and Auchadaduie grouping to the south, and the Narachan and High Constellation group to the north. The Proposed Development would be in closer proximity to this viewpoint and as a consequence would represent a notable additional feature in the view.

Aviation lights on 8 of the proposed turbines would be visible at this location. The addition of these features would be seen as a separate and relatively even array of red lights to the south of the Narachan scheme. They would extend the influence of aviation lighting to a slightly greater portion of the overall views. The Proposed Development would be slightly closer to this location. However, the lighting is likely to appear at a similar intensity to those of Narachan as a result of the vertical angle of view.

In this scenario, the magnitude of cumulative change is considered to be similar to that of Scenario 1, and as such within the **Medium** threshold. The cumulative level of effect in this scenario is judged to be **Moderate (significant)**.

Table 51 Cumulative Effects on receptors in the south of Gigha

Viewpoint 9: Gigha, South Pier (see Figures VP9.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

A number of the identified cumulative wind farms would be visible along the length of the Kintyre peninsula from this island location. The Beinn an Tuirc I-III and Blary Hill schemes would be seen as one large and relatively prominent group of varying turbine sizes, with Auchadaduie slightly outlying at its southern extent. The Tangy IV scheme forms a cluster further to the south along Kintyre. To the north of Kintyre, the fleeting blade tips of High Constellation would be visible. Airigh Wind Farm would form a compact, distant cluster on Knapdale, although would be partially screened from this location by intervening landform. The Gigha and Leim Farm schemes are visible in close proximity to the west of this location.

The addition of the Proposed Development would extend the influence of wind turbines in this part of the view further north. From this direction there would be a slight separation between the Proposed Development and the large cluster of wind turbines formed by Beinn an Tuirc I-III and Blary Hill, similar to that between this cluster and Auchadaduie to the south. The turbine sizes vary between each scheme and the Proposed Development would add further difference to this composition. The Proposed Development would result in a noticeable additional change and increase in the extent of wind farms in the view.

The magnitude of cumulative change resulting is judged to be **Medium**. The cumulative level of effect in this Scenario is judged to be **Moderate (significant)**.

Viewpoint 9: Gigha, South Pier (see Figures VP9.2, EIAR Volume 2d)

Scenario 2 (existing, consented, under construction and application stage schemes)

This scenario sees the introduction of the Sheirdrim and Narachan wind farms into the cumulative baseline. Sheirdrim would be visible to the north-east, extending the influence of wind farms to northern Kintyre. Narachan would appear close to High Constellation, adding a further wind farm to central Kintyre. At night it would also see the introduction of up to 7 medium intensity aviation lights slightly above the outline of the peninsula.

The Proposed Development would add to the number of turbines within this segment of the view. The proposed turbines would sit inland beyond the ridgeline of Kintyre in a manner similar to those at Beinn an Tuirc I-III, Blary Hill and Narachan.

In this scenario the Proposed Development would occupy a space between the Beinn an Tuirc I-III, Blary Hill and Auchadaduie grouping to the south, and the Narachan and High Constellation group to the north. The Proposed Development would reduce the separation between schemes, nonetheless the effect of distance would still give a sense of three distinct groups of turbines. The horizontal extent of the Proposed Development would be similar to both groups, although located in slightly closer proximity to this location.

Aviation lights on 8 of the proposed turbines would be visible from this location. The addition of these features would be seen as a separate and relatively even array of red lights to the south of the Narachan scheme. They would extend the influence of aviation lighting to a slightly greater proportion of the overall views. The Proposed Development would be slightly closer to this location. However, the lighting is likely to appear at a similar intensity to those of Narachan as a result of the vertical angle of view.

In this scenario, the magnitude of cumulative change is considered to be marginally lower than that of the LVIA, but still within the **Medium** threshold. The cumulative level of effect is judged to be **Moderate (significant)**.

Table 52 Cumulative Effects on passengers using the Gigha Ferry

Viewpoint 10: Sound of Gigha from Gigha Ferry (see Figures VP10.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

The Tangy IV scheme forms a distant cluster to the south-east of this location. Three blades of the Auchadaduie Wind Farm would appear as relatively minor features to the south of Glen Barr, slightly separate from the tightly clustered and more distant Tangy schemes. Blades of the Blary Hill scheme would be visible above the intervening inland ridgeline and would appear at a similar scale and in close proximity to the Auchadaduie scheme. Airigh is seen to the north as a compact, distant cluster.

The proposed turbines would sit inland, beyond the ridgeline of Kintyre and as such would be partially screened from this location. The Proposed Development would extend the existing influence of wind energy to the north of the baseline schemes, and closer to this location. The addition of the Proposed Development would result in a noticeable increase in the prominence and extent of wind turbines seen from this location. Due to the nature of this receptor such views would be of relatively short duration, and the influence of the scheme would vary depending on proximity to the mainland coast and direction of travel.

The magnitude of cumulative change resulting is judged to be **Medium**. The cumulative level of effect in this scenario is judged to be **Moderate (significant)**.

Viewpoint 10: Sound of Gigha from Gigha Ferry (see Figures VP10.2, EIAR Volume 2d)

Scenario 2 (existing, consented, under construction and application stage schemes)

This scenario sees the introduction of the Narachan Wind Farm into the cumulative baseline, adding a further cluster of turbines to the view and extending their influence further north on Kintyre. At night, this scheme would also see the introduction of up to 2 medium intensity aviation lights along the outline of the peninsula, although 1 of these is likely to be screened by forestry.

The Proposed Development would occupy a place on the skyline between the Blary Hill and Auchadaduie group to the south and Narachan to the north, with clear separation between the schemes. The addition of the Proposed Development would create a relatively evenly spaced series of turbine groups/clusters along the Kintyre skyline. The Proposed Development would be in closer proximity to this viewpoint than the other schemes and this, together with its greater horizontal extent, would result in a noticeable increase in the prominence of wind turbines seen from this location.

Aviation lights on 5 of the proposed turbines would be visible at this location. The addition of these features would be seen as a separate group of lights slightly above the silhouette of Kintyre to the south of the single visible Narachan aviation light. They would extend the influence of aviation lighting to a greater proportion of the overall views. The Proposed Development would be slightly closer to this location, but the aviation lighting is likely to appear at a similar intensity due to the greater vertical angle of view.

The magnitude of cumulative change resulting is judged to be **Medium**. The cumulative level of effect in this scenario is judged to be **Moderate (significant)**.

Table 53 Cumulative Effects on receptors at Rhunahaorine / Point Sands and caravan park

Viewpoint 11: Rhunahaorine / Point Sands near caravan park (see Figures VP11.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

The tips of two turbines at Auchadaduie and Tangy IV are theoretically visible from this location but would be largely imperceptible and therefore would not contribute to the cumulative baseline. Similarly, Airigh Wind Farm is theoretically visible to the north, but would be screened by woodland. The only other cumulative turbines visible would be those on Gigha which are already present in the baseline and as such the level of effect would be the same as that described for the LVIA, **Minor (not significant)**.

Scenario 2 (existing, consented, under construction and application stage schemes)

As above.

Table 54 Cumulative Effects on receptors at Tayinloan Ferry Terminal

Viewpoint 12: Tayinloan Ferry Terminal (see Figures VP12.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

Although theoretically visible in the distance to the north, Airigh Wind Farm would be screened from this location by buildings in the foreground. The only other cumulative turbines visible would be those on Gigha which are already present in the baseline and as such the level of effect would be the same as that described for the LVIA, **Minor (not significant)**.

Viewpoint 12: Tayinloan Ferry Terminal (see Figures VP12.2, EIAR Volume 2d)

Scenario 2 (existing, consented, under construction and application stage schemes)

This scenario sees the introduction of the Narachan Wind Farm into the cumulative baseline. However, visibility of this scheme would be limited to one blade tip and as such the cumulative baseline and level of effect would be perceived as the same as Scenario 1, **Minor (not significant)**.

Table 55 Cumulative Effects on users of the Kintyre Way adjacent to the Development Site

Viewpoint 13: Kintyre Way north of Development Site (see Figures VP13.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

Two cumulative schemes are visible to the north-east of this viewpoint. The Deucheran Hill Wind Farm is prominent in views to the north-east, with three blades of the Cour Wind Farm visible in the same part of the view. Both schemes are present within the existing baseline and as such the cumulative effect resulting from the addition of the Proposed Development would be the same as that reported for the LVIA, **Major (significant)**.

Scenario 2 (existing, consented, under construction and application stage schemes)

This scenario sees the introduction of the Narachan Wind Farm into the cumulative baseline. Fleeting blade tips and blades of Narachan would be seen in combination with other cumulative schemes and enlarge the extent of wind turbines within this part of the view.

The addition of the Proposed Development would introduce wind turbines into a new part of the view, thus would increase the overall influence of wind energy in the views from this location. The proposed turbines would be in closer proximity to this location and as such would be more prominent.

The magnitude of cumulative change resulting is judged to be **High**. The cumulative level of effect in this scenario is judged to be **Major (significant)**.

Sequential Effects

In addition to potential cumulative effects from this static location on the Kintyre Way there is also potential for sequential cumulative effects, when considering the route as a whole. As indicated by the cumulative ZTVs (Figures 7.13 and 7.14, EIAR Volume 2c) the cumulative baseline for both scenarios as experienced from the route is one of relatively widespread visibility of wind farms. In reality the route passes through large areas of forestry and as such outward visibility is reduced. The route also passes through and in close proximity to a number of the cumulative schemes, most notably Eascairt, Sheirdrim, Deucheran Hill and Beinn an Tuirc III. Visibility of the Proposed Development would be limited to a few short sections, with no visibility from the majority of the route. Therefore, although the Proposed Development would have some local influence on views this would represent a very small additional change which would not alter the overall experience of the route.

Table 56 Cumulative Effects on receptors at A'Chleit

Viewpoint 14: A'Chleit (see Figures VP14.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

Two cumulative schemes would be visible from this location, with the Gigha and Leim Farm turbines seen across the sound to the north-west, and Airigh a distant feature to the north. The Proposed Development would be predominantly screened by the intervening inland ridgeline on Kintyre, with visibility limited to a small number of blades. The addition of the Proposed Development would introduce wind turbines into a small part of views inland, in a less important part of the wider panorama focused to the seascape to the west and along the coast to the north and south.

The magnitude of cumulative change is judged to be **Low**. The cumulative level of effect in this scenario is judged to be **Minor (not significant)**.

Scenario 2 (existing, consented, under construction and application stage schemes)

No further cumulative schemes would be visible in this scenario; thus, the additional cumulative effect of the Proposed Development would be the same as Scenario 1, **Minor (not significant)**.

Table 57 Cumulative Effects on receptors in the Sound of Gigha

Viewpoint 15: Sound of Gigha from recreational watercraft (see Figures VP15.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

The Beinn an Tuirc I-III, Blary Hill and Auchadaduie schemes form a large grouping of wind turbines to the south-east of this location. The latter is visible on the upper coastal slopes, while other schemes would appear to recede into the distant uplands. The Tangy IV scheme would be seen as a separate large scheme further south along the peninsula. Airigh Wind Farm would be seen as a distant and isolated cluster to the north, within the same view as the Gigha and Leim Farm turbines on Gigha.

The addition of the Proposed Development would result in an increase in the appearance and extent of wind turbines further to the north of Kintyre. It would be seen in combination with, but separated from, the large group of turbines to the south formed by Beinn an Tuirc I-III, Blary Hill, and Auchadaduie. The proposed turbines would fit the pattern of a series of large clusters and groups of turbines seen along the uplands of Kintyre. Due to the nature of this receptor such views would tend to be of short duration, and the influence of the Proposed Development and other wind farms would vary depending on proximity to the mainland coast and travel direction.

From the viewpoint location, the magnitude of cumulative change is judged to be **Medium**. The cumulative level of effect in this scenario is judged to be **Moderate (significant)**. From other locations further to the north and south where recreational watercraft would be in closer proximity to cumulative schemes the level of change resulting from the Proposed Development would be reduced.

Viewpoint 15: Sound of Gigha from recreational watercraft (see Figures VP15.2, EIAR Volume 2d)

Scenario 2 (existing, consented, under construction and application stage schemes)

This scenario sees the introduction of the Narachan Wind Farm into the cumulative baseline. Fleeting blade tips and blades of Narachan would be seen in combination with other cumulative schemes, extending the influence of wind energy further to the north of Kintyre.

The Proposed Development would occupy a space between Narachan to the north and the large grouping of Beinn an Tuirc I-III, Blary Hill, and Auchadaduie to the south. However, the influence of the Narachan scheme within the view is limited. Thus, the additional cumulative effect of the Proposed Development would be the same as Scenario 1, **Moderate (significant)**.

Table 58 Cumulative Effects on receptors at North Muasdale

Viewpoint 16: North Muasdale (see Figures VP16.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

No cumulative schemes would be visible from this location.

Scenario 2 (existing, consented, under construction and application stage schemes)

No cumulative schemes would be visible from this location.

Table 59 Cumulative Effects on users of the A83 south of Muasdale

Viewpoint 17: A83 south of Muasdale (see Figures VP17.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

The Airigh scheme would be visible as a distant and compact cluster, seen on Knapdale to the north, with the Gigha and Leim Farm turbines visible across the sound to the north-west.

The addition of the Proposed Development would introduce the tops of a small number of wind turbines beyond the inland ridge. Taking into account the screening provided by landform, intervening distance and glimpsed nature of views, the Proposed Development would be a minor element within a small part of the view and would not increase the prominence of wind farms.

The magnitude of cumulative change is judged to be **Very Low** and the cumulative level of effect **Negligible (not significant)**.

Scenario 2 (existing, consented, under construction and application stage schemes)

No further cumulative schemes would be visible. The level of cumulative effect would remain the same as Scenario 1, **Negligible (not significant)**.

Sequential Effects

The visibility of the Proposed Development from the northbound A83 is limited to a few localised points and short sections as represented by Viewpoint 17 and Viewpoint 20. The cumulative ZTV (Figure 7.14, EIAR Volume 2c) indicates that the Proposed Development would not add visibility of wind farms to any additional sections of the route in both Scenarios 1 and 2. Cumulative effects on the wider northbound A83 would therefore be very limited, and less than that experienced from the viewpoint locations.

Table 60 Cumulative Effects on receptors at Glenacardoch

Viewpoint 18: Glenacardoch (see Figures VP18.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

The operational turbines at Beinn an Tuirc I, Auchadaduie, and the consented and under construction Blary Hill would be visible from this location and combine to form a large group of turbines to the east. Beinn an Tuirc is more distant and partially screened by forestry, with the Blary Hill and Auchadaduie schemes in closer proximity and more prominent. The Tangy IV scheme would be screened by foreground buildings from the viewpoint location, but visible from the surrounding area, extending the influence of wind farms further south. Airigh Wind Farm would be seen as a compact and distant cluster to the north, with the Leim Farm and Gigha turbines viewed as a small, compact group to the north-west, clearly separate from the mainland.

The Proposed Development would be seen in combination and succession with cumulative schemes, though clearly separated from the large group to the south and isolated cluster of Airigh to the north. The majority of the proposed turbines would be screened by intervening landform and forestry. Due to the limited visibility of the Proposed Development it would result in only a limited additional cumulative change and would not alter the overall prominence of wind turbines in the view.

The magnitude of cumulative change is judged to be **Low** and the cumulative level of effect **Minor (not significant)** in this scenario.

Scenario 2 (existing, consented, under construction and application stage schemes)

No further cumulative schemes would be visible. The level of cumulative effect would remain the same as Scenario 1, **Minor (not significant)**.

Table 61 Cumulative Effects on receptors at Beinn an Tuirc summit

Viewpoint 19: Beinn an Tuirc (see Figures VP19.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

The majority of the cumulative sites identified in the baseline would be visible from this location. The Beinn an Tuirc, Blary Hill, Auchadaduie and Tangy IV wind farms encircle this location to the north, west and south; the Beinn an Tuirc I-II turbines are most prominent in the immediate foreground. The Airigh, Deucheran Hill, High Constellation, Freasdail, Eascairt and Cour wind farms are more distant and separated from these schemes to the north. The Gigha and Leim Farm turbines are clearly separate from the mainland wind farms.

The Development would extend the influence of wind energy across the mid-ground of the view to the west; similar to the Blary Hill and BAT III schemes. There is sufficient separation between the foreground schemes and the proposed turbines in the mid-ground such that it is possible to make a distinction between the arrangements and pattern of the individual arrays.

The existing Beinn an Tuirc Wind Farm is very prominent and exerts a strong influence on this view. The Proposed Development would be less prominent but would result in a perceptible increase in the number of wind turbines within one part of the panoramic view experienced in the round.

Overall, the magnitude of cumulative change is judged to be **Low**. The cumulative level of effect in this scenario is judged to be **Minor (not significant)**.

Viewpoint 19: Beinn an Tuirc (see Figures VP19.2, EIAR Volume 2d)

Scenario 2 (existing, consented, under construction and application stage schemes)

This scenario sees the introduction of the Narachan and Sheirdrim wind farms into the cumulative baseline. These schemes would enlarge and extend the clusters of Deucheran Hill, High Constellation, Cour, Freasdail, Eascairt, and the more distant Airigh Wind Farm, such that it would appear as one large grouping of turbines within the uplands of Kintyre to the north. At night, aviation lights on 16 of the Narachan turbines would be visible back clothed by the dark moorland landscape.

In a scenario where large groups of turbines have a strong influence in the foreground and background in-combination and successive views, the addition of the Development to the mid-ground would amount to a small but perceptible increase in wind turbines from this location.

Aviation lights on 8 of the proposed turbines would be visible from this location. The addition of these features would be seen as a separate, more widely spaced and even array of red lights, further to the west. They would be seen slightly closer to this viewpoint and would increase the horizontal extent and influence of light sources within the view. Few people are likely to be at this location at night to appreciate the change to the view.

The magnitude of cumulative change is judged to be **Low**. The cumulative level of effect in this scenario is judged to be **Minor (not significant)**.

Table 62 Cumulative Effects on users of the A83 near Bellochantuy

Viewpoint 20: A83 near Bellochantuy (see Figures VP20.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

The small scale Gigha and Leim Farm turbines are visible as a distant and compact cluster, seen on Gigha. These turbines are part of the existing baseline and as such the cumulative effect resulting from the addition of the Proposed Development would be the same as that reported for the LVIA, **Negligible (not significant)**.

Scenario 2 (existing, consented, under construction and application stage schemes)

As above

Table 63 Cumulative Effects on passengers of the Lochranza to Claonaig Ferry

Viewpoint 21: Lochranza to Claonaig Ferry (see Figures VP21.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

A number of the identified cumulative sites would be visible, seen in distinct groups along the uplands of the Kintyre peninsula; furthest south is the large grouping formed by Beinn an Tuirc I-III; in the central part of Kintyre is the group formed by Cour and High Constellation, with Deucheran Hill slightly outlying to the south; and to the north of the peninsula the cluster of Freasdail and prominent array of Eascairt would be visible.

Supplementary cumulative wirelines C3 (north-west of Pirnmill) and C4 (Machrie Bay) (Figure CW3 and CW4, EIAR Volume 2d) illustrate the likely visibility of the identified cumulative schemes from other locations within the Kilbrannan Sound. From both locations, the Cour, High Constellation, Beinn an Tuirc I-III and Deucheran Hill schemes are seen as a series of clusters and large groups along the upland skyline. The Cour, High Constellation and Eascairt schemes which are sited closer to the eastern coast of Kintyre are noticeably more prominent, particularly to the north of the Sound.

The Proposed Development would be largely screened by intervening topography from the ferry and the wider Kilbrannan Sound. The addition of the visible parts of the proposed turbines would often be seen behind Deucheran Hill and the two schemes would be perceived as one.

As a result of the limited visibility of the Proposed Development and presence of a number of more prominent schemes, the magnitude of cumulative change is judged to be **Very Low**. The cumulative level of effect in this scenario is judged to be **Negligible (not significant)**.

Scenario 2 (existing, consented, under construction and application stage schemes)

This scenario sees the introduction of the Narachan and Sheirdrim wind farms into the cumulative baseline. Narachan would be visible behind parts of the Cour and High Constellation schemes and thus increase the presence of turbines within this part of the view. Sheirdrim would fill the gap between Eascairt and Freasdail such that it would be perceived as one large and extensive group of turbines to the north of Kintyre. Aviation lighting on the Narachan turbines would be visible from much of this route, with lights on 6 turbines potentially visible from the viewpoint location.

As for Scenario 1 the Proposed Development would be a very minor and distant element in the view from this location which includes several other more prominent wind farms. An aviation light on one of the proposed turbines would potentially be visible at this location, seen along the dark skyline of Kintyre. The addition of this feature would be perceptible in certain conditions, but in isolation would be hard to distinguish in the broad and open context.

The Proposed Development would, for the reasons above, be a minor element perceived in the context of several large groups of wind turbines on Kintyre. The magnitude of cumulative change is judged to be **Very Low**. The cumulative level of effect in this scenario is judged to be **Negligible (not significant)**.

Table 64 Cumulative Effects on receptors at Newton Point, Arran

Viewpoint 22: Newton Point, Arran (see Figures VP22.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

A number of the identified cumulative sites would be visible, seen in clusters along the uplands of the Kintyre; furthest south is the compact cluster of Deucheran Hill. Within the central part of Kintyre is the group formed by Cour and High Constellation. The prominent array of Eascairt, and clusters of blades of the Freasdail and Airigh schemes are visible to the north of the peninsula.

Supplementary cumulative wirelines C1 (Catacol) and C2 (Rubha Airigh Bheirg) (Figures CW1 and CW2, EIAR Volume 2d) illustrate the likely visibility of the identified cumulative schemes from other locations along the north Arran coast. These demonstrate a similar pattern of cumulative developments to those seen from Newton Point, with Deucheran Hill a small cluster to the south, Cour and High Constellation a more notable and larger cluster in central Kintyre and Eascairt and Freasdail visible further north. The visibility of Freasdail is reduced further south towards C2, although the Eascairt scheme remains prominent.

The Proposed Development would be largely screened from each of these locations and the north Arran coast by intervening topography. The addition of the visible parts of the proposed turbines would be seen behind Deucheran Hill and the two schemes would be perceived as one, with the Proposed Development being a minor element. The magnitude of cumulative change is judged to be **Very Low**. The cumulative level of effect in this scenario is judged to be **Negligible (not significant)**.

Scenario 2 (existing, consented, under construction and application stage schemes)

This scenario sees the introduction of the Narachan and Sheirdrim wind farms into the cumulative baseline. Narachan would be visible behind parts of the Cour and High Constellation schemes and thus increase the presence of turbines within this part of the view. Sheirdrim would fill the gap between Eascairt and Freasdail such that it would be perceived as one large and extensive group of turbines to the north of Kintyre. At night, the aviation lighting on 12 of the Narachan turbines would be visible along and slightly above the distant silhouette of Kintyre.

As for Scenario 1 the Proposed Development would be a very minor and distant element in the view from this location which includes several other more prominent wind farms. An aviation light on one of the proposed turbines would potentially be visible at this location, seen along the dark skyline of Kintyre. The addition of this feature would be perceptible in certain conditions, but in isolation would be hard to distinguish in the broad and open context.

The Proposed Development would, for the reasons above, be a minor element perceived in the context of several large groups of wind turbines on Kintyre. The magnitude of cumulative change is judged to be **Very Low**. The cumulative level of effect in this scenario is judged to be **Negligible (not significant)**.

Table 65 Cumulative Effects on users of the A841 at Whitefarland

Viewpoint 23: A841, Whitefarland (see Figures VP23.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

A number of the identified cumulative sites are visible along the skyline of Kintyre, with Cour and High Constellation the most prominent as a large group. The individual schemes form coherent clusters, well-spaced along the undulating peninsula. Eascairt would add a further wind farm along the skyline of Kintyre, in a similar part of the view as Freasdail, but of greater prominence

The Proposed Development would be seen in combination with several of the identified cumulative schemes and would introduce a further cluster of turbines into the view along the Kintyre peninsula. The Proposed Development would be sited beyond intervening landform and as such would largely be screened from this location.

As a result of distance, the limited visibility of the Proposed Development, and taking into consideration the greater prominence of cumulative schemes seen in combination and succession, the proposed turbines would not increase the overall prominence of wind farms. The magnitude of cumulative change is judged to be **Very Low**. The cumulative level of effect in this scenario is judged to be **Negligible (not significant)**.

Scenario 2 (existing, consented, under construction and application stage schemes)

This scenario sees the introduction of the Narachan and Sheirdrim wind farms into the cumulative baseline. Narachan would become one of the more prominent schemes in the view, enlarging the group formed by Cour and High Constellation. Sheirdrim would enlarge the group formed by Eascairt and Freasdail to the north of Kintyre. At night, aviation lights on 15 of the Narachan turbines would be visible above the distant silhouette of Kintyre in a relatively widely spaced array.

The effects attributable to the Proposed Development would diminish as a result of the proposed wind farms further increasing the prominence of wind energy within the view.

An aviation light on one of the proposed turbines would be visible at this location, seen just above the dark skyline of Kintyre. The addition of this feature would be perceptible in certain conditions and may appear to increase the horizontal extent of aviation lighting but would be very distant and in isolation would be hard to distinguish in the broad and open context.

The magnitude of cumulative change is judged to be within the **Very Low** threshold. The cumulative level of effect in this scenario is judged to be **Negligible (not significant)**.

Table 66 Cumulative Effects on receptors at Beinn Bharrain

Viewpoint 24: Beinn Bharrain (see Figures VP24.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

The majority of the identified cumulative schemes are visible from this elevated, panoramic viewpoint. The Beinn an Tuirc I-II, Blary Hill, Auchadaduie and Tangy IV arrays together are likely to be perceived by most as one large, extensive wind farm to the south of Kintyre. The Deucheran Hill cluster would stand alone in the central part of the peninsula, with High Constellation and Cour forming a large group further north on the eastern upland slopes. To the north of Kintyre, the Freasdail and Eascairt schemes would appear as a further large group, with separation to the more distant Airigh scheme that would also be seen in this part of the view.

The addition of the Proposed Development would introduce a further cluster of wind turbines within the central parts of upland Kintyre. The proposed turbines would be partially screened by intervening landform which would reduce their prominence compared to schemes set on the eastern slopes of the peninsula. While the Proposed Development would be larger in extent than the nearby Deucheran Hill wind farm, the difference in scale would be diminished by the variety of turbine scales visible in combined and successive views. The magnitude of cumulative change is judged to be **Low**. The cumulative level of effect in this scenario is judged to be **Minor (not significant)**.

Scenario 2 (existing, consented, under construction and application stage schemes)

This scenario sees the introduction of the Narachan and Sheirdrim wind farms into the cumulative baseline. Narachan would become a prominent scheme in the view, enlarging the group formed by Cour and High Constellation. Aviation lights on each of the Narachan turbines would also be visible from this location. Sheirdrim would fill the gap between the Eascairt, Freasdail and Airigh schemes, which would extend and increase the influence of this large group to the north of the peninsula.

The effects attributable to the Proposed Development from this location would diminish as a result of the proposed wind farms increasing the prominence of wind energy within the view.

Aviation lights on 8 of the proposed turbines would be visible from this location. The addition of these features would be seen as a separate and more compact array of red lights. They would be more distant, occupy a smaller part of the view and appear slightly less prominent than the lights on Narachan, but would slightly increase the horizontal extent and influence of light sources within the view.

The magnitude of cumulative change is judged to be within the **Low** threshold. The cumulative level of effect in this scenario is judged to be **Minor (not significant)**.

Table 67 Cumulative Effects on receptors at Goatfell, Arran

Viewpoint 25: Goatfell, Arran (see Figures VP25.2, EIAR Volume 2d)

Scenario 1 (existing, consented and under construction schemes)

The majority of the identified cumulative schemes are visible from this elevated, panoramic viewpoint, as are a number of other schemes in the distance to the north and east. The Beinn an Tuirc I-II, Blary Hill, Auchadaduie and Tangy IV arrays together are likely to be perceived by most as one large, extensive wind farm to the south of Kintyre. To the north of Kintyre, the Freasdail, Eascairt and Airigh schemes would appear as a further large but unevenly spread group. High Constellation would appear as an isolated cluster partially screened by intervening landform.

The addition of the Proposed Development would introduce a further cluster of wind turbines into upland Kintyre at a distance of over 26 km. The proposed turbines would be partially screened by intervening landform which would further reduce their presence in the broad 360° views.

The magnitude of cumulative change is judged to be **Very Low**. The cumulative level of effect in this scenario is judged to be **Negligible (not significant)**.

Scenario 2 (existing, consented, under construction and application stage schemes)

This scenario sees the introduction of the Narachan and Sheirdrim wind farms into the cumulative baseline. Narachan would be visible as an additional large but distinct cluster, in the view to the south of high Constellation. Aviation lights on 13 of the Narachan turbines would also be visible from this location. Sheirdrim Wind Farm would fill the gap between the Eascairt, Freasdail and Airigh, which would extend and increase the influence of this large group to the north of the peninsula.

The effects attributable to the Proposed Development would diminish slightly as a result of the proposed wind farms further increasing the prominence of wind energy within the view.

Aviation lights on 8 of the proposed turbines would be visible from this location. The addition of these features would be seen as a separate and more compact array of red lights. They would be more distant, occupy a smaller part of the view and appear slightly less prominent than the lights on Narachan, but would slightly increase the horizontal extent and influence of light sources within the view.

The magnitude of cumulative change is judged to be within the **Very Low** threshold. The cumulative level of effect in this scenario is judged to be **Negligible (not significant)**.

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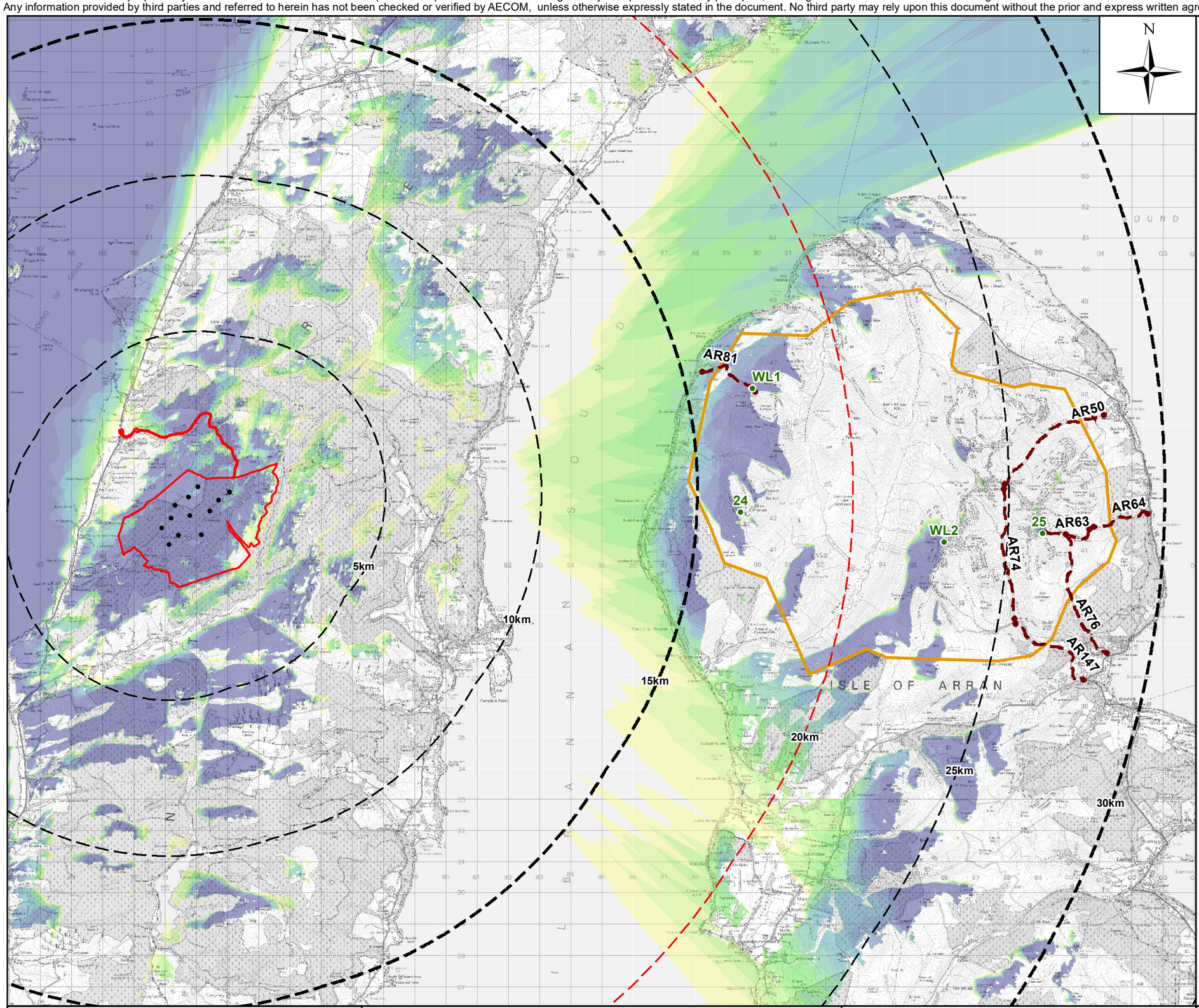
Figure: 7.4.1



KEY:

- Development Site
- Proposed Turbine Location
- Viewpoint Location
- 5km Distance Bands from Outermost Turbines
- Detailed Study Area
- Core Path within Wild Land Area (WLA)
- North Arran Wild Land Area (WLA)

Number of Turbines Visible:

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12

NOTE:
Zone of Theoretical Visibility (ZTV) has been generated using Ordnance Survey Terrain 5 digital terrain model, which does not take account of the screening effects of vegetation, buildings or other structures.

ZTV is based upon a maximum layout of 12 turbines using an observer eye height of 2m above ground level.
Tip Height: T1-T6 & T8 - 185m, T7 & T10-T14 - 200m

All heights mentioned are above ground level (AGL).

0 5 km

Client: RWE	Title: FIGURE 7.4.1 NORTH ARRAN WILD LAND AREA AND ZONE OF THEORETICAL VISIBILITY (TIP HEIGHT)	AECOM One Trinity Gardens Quayside Newcastle, NE1 2HF Tel +44 (0) 191 224 6500 Fax +44 (0) 191 224 6599 www.aecom.com	Drawn: LC / Checked: AR
Project: CLACHAIG GLEN WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT			Verified: JD / Approved: SW
			Date: JANUARY 2022 / Scale at A3: 1:125,000
			Drawing Number: CG_220105_EIA_A7.4.1_v4 / A3

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8.1, 8.2, and 8.3

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Appendix 8.1: Guidance

Appendix 8.1 Guidance

1. National Planning Guidance

1.1.1 General planning advice relating to noise associated with new developments in Scotland is presented in Planning Advice Note (PAN) 1/2011: Planning and Noise (Scottish Government, 2011a). The purpose of PAN 1/2011 is to provide advice on the role of the planning system in helping to prevent and limit the adverse effects of noise. Information and advice on noise impact assessment (NIA) methods is provided in the associated Technical Advice Note. It includes details of the legislation, technical standards and codes of practice for specific noise issues.

1.1.2 Paragraph 29 of PAN1/2011, where wind turbine developments are discussed, states:

"There are two sources of noise from wind turbines - the mechanical noise from the turbines and the aerodynamic noise from the blades. Mechanical noise is related to engineering design. Aerodynamic noise varies with rotor design and wind speed, and is generally greatest at low speeds. Good acoustical design and siting of turbines is essential to minimise the potential to generate noise. Web based planning advice on renewable technologies for Onshore wind turbines provides advice on 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97) published by the former Department of Trade and Industry [DTI] and the findings of the Salford University report into Aerodynamic Modulation of Wind Turbine Noise."

1.1.3 The accompanying Technical Advice Note (TAN) to PAN 1/2011 (Scottish Government, 2011b) further states.

"Advice on Onshore Wind Turbines provides advice based on 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97) published by the former Department of Trade and Industry (DTI). This document provides a framework for the measurement of wind farm noise and gives indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding unduly to the costs and administrative burdens on wind farm developers. ETSU-R-97 presents relevant guidance on good practice and lists a series of recommendations."

2. Other Guidance

2.1 ETSU-R-97 The Assessment and Rating of Wind Turbine Noise

2.1.1 ETSU-R-97 is used throughout the UK to assess wind farm noise in planning applications. ETSU-R-97 was prepared by a Noise Working Group of developers, noise consultants, environmental health officers and others set up in 1995 by the Department of Trade and Industry through ETSU (the Energy Technology Support Unit). The preface to ETSU-R-97 says:

"The aim of the Working Group was to provide information and advice to developers and planners on the environmental assessment of noise from wind turbines. While the DTI facilitated the

establishment of this Noise Working Group this report is not a report of Government and should not be thought of in any way as replacing the advice contained within relevant Government guidance. The report represents the consensus view of the group of experts listed below who between them have a breadth and depth of experience in assessing and controlling the environmental impact of noise from wind farms. This consensus view was arrived through negotiation and compromise and in recognition of the value of achieving a common approach to the assessment of noise from wind turbines."

2.1.2 The first paragraph of the executive summary says, *"This document describes a framework for the measurement of wind farm noise and gives indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding unduly to the costs and administrative burdens on wind farm developers or local authorities."*

2.1.3 The technical detail of ETSU-R-97 is important, but in summary this guidance requires the predicted noise levels from the wind turbine under a range of wind speeds to be compared with the background noise level at noise sensitive premises under similar wind conditions. Noise limits (in terms of L_{A90}) are set at 5 dB above the L_{A90} background noise level, subject to a lower limit of 43 dB at night and 35 to 40 dB during the day.

2.1.4 ETSU-R-97 makes it clear that any noise restrictions placed on a wind farm must balance the environmental impact of the wind farm against the benefits that flow from the development of renewable energy sources:

"The planning system must therefore seek to control the environmental impacts from a wind farm whilst at the same time recognising the national and global benefits that would arise through the development of renewable energy sources and not be so severe that wind farm development is unduly stifled."

Limit Values

2.1.5 The daytime minimum fixed values are chosen to protect a property's external amenity, and night-time minimum fixed values are chosen to prevent sleep disturbance indoors, assuming partially open windows. Consequently, the daytime values are lower than those for night-time as even with windows partially open the building envelope has been assumed to provide a considerable degree of noise attenuation.

2.1.6 The daytime criterion is derived from the baseline measurements during the so-called 'quiet periods of the day', which comprise weekday evenings (18:00 to 23:00), Saturday afternoons and evenings (13:00 to 23:00), and all day and evening on Sundays (07:00 to 23:00). However, the limit applies to all daytime hours (07:00 to 23:00).

2.1.7 The daytime noise minimum fixed value can be chosen from the range $L_{A90,10min}$ 35-40 dB. The precise choice of value depends on a number of factors as described on page viii of ETSU-R-97, including:

- the number of dwellings in the neighbourhood of the wind farm,

- the effect of noise limits on the number of kilowatt hours (kWh) generated, and
- the duration and level of exposure.

2.1.8 The night-time noise criterion curve is derived from background noise level data measured during the night-time period (23:00 to 07:00), with no differentiation being made between weekdays and weekends. Where the night-time criterion curve based on 5 dB above the measured background noise level is found to be below $L_{A90,10min}$ 43 dB, it is fixed at a minimum value of $L_{A90,10min}$ 43 dB. This night-time fixed value is based on the World Health Organisation's (WHO) Environmental Health Criteria 12 (EH 12), for the protection of sleep indoors with windows open and an assumed composite façade sound reduction of 10 dB (WHO, 1980).

2.1.9 The exception to the setting of both the ETSU-R-97 quiet daytime and night-time minimum fixed limits occurs where the occupier of a property has a financial involvement in the wind farm development. Where this is the case then, if the derived criterion curve based on 5 dB (or higher) above the measured background noise level falls below $L_{A90,10min}$ 45 dB, the minimum fixed noise limit at that property may be set to $L_{A90,10min}$ 45 dB (or greater) during both the daytime and the night-time periods alike.

2.2 IOA: A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and rating of Wind Turbine Noise (IOA Good Practice Guidance; GPG) 2013

2.2.1 In May 2013 the Institute of Acoustics (IOA) provided additional guidance on the use of ETSU-R-97 entitled: A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and rating of Wind Turbine Noise (IOA 2013). The terms of reference of the IOA working group states:

"the purpose of the guidance document is to provide assistance to the target audience on technical matters relating to the application of ETSU-R-97 to wind farm noise assessments. It is not the role of the working group or the guidance document to debate or otherwise discuss the target noise levels, as this is a matter of policy for the respective Government departments."

2.2.2 Page 17 of the IOA GPG provides the following guidance on the daytime noise minimum fixed value:

1. "*The number of neighbouring properties will depend on the nature of the area, (rural, semi-rural, urban) and is sometimes considered in relation to the size of the scheme and study area. The predicted 35 dB $L_{A90,T}$ contour (at maximum noise output up to 12 ms-1) can provide a guide to the dwellings to be considered in this respect.*

2. *This is in practice mainly based on the relative generating capacity of the development, as larger schemes have relatively more planning merit (for noise) according to the description in ETSU R 97. In cases when the amenity fixed limit has little or no impact on the generating capacity (i.e., noise is not a significant design constraint) then a reduced limit may be applied.*

3. *This last test is more difficult to formulate. But ETSU-R-97 notes that the likely excess of turbine noise relative to background noise levels should be a relevant consideration. In rural areas, this will often be determined by the sheltering of the property relative to the wind farm*

site. Account can also be taken of the effects of wind directions (including prevailing ones at the site) and likely directional effects. For cumulative developments, in some cases the effective duration of exposure may increase because of cumulative effects."

2.2.3 The IOA GPG summarises the noise model propagation and input data in Summary Box 20 (Page 21) of the guidance document as follows:

- "*Whilst it is acknowledged that some of the source documents for sound power levels may be confidential, numerical values of the source data should be clearly set out in any assessment and it is good practice to reference the data sources used.*
- L_{A90} *levels should be determined from calculated* L_{Aeq} *levels by subtraction of 2 dB.*
- *Predictions should be based on octave band frequency data whenever available.*
- *Current good practice is that tonal issues for wind farms are generally best dealt with through a suitable planning condition.*
- *When applying the ISO 9613-2 standard:*
  - *Equation 9 of the standard should be used to calculate ground effects; if no representative spectral data can be obtained,* A_{gr} *= -3 dB should be used and the air absorption rate corresponding to the 250 Hz octave band,*
  - *A ground factor of G=1 should not be used,*
  - *With the exception of propagation over large bodies of water or in urban areas, it is recommended to use a ground factor of G=0.5, in combination with emission levels which include a margin of uncertainty,*
  - *The input data used should be clearly set out with reference to its source, and a statement on how robust it is considered to be,*
  - *Any assumed reduced mode operation for the turbines should be clearly set out,*
  - *A receiver height of 4.0 m, and atmospheric conditions of 10°C and 70% humidity should be used.*
- *Topographic screening effects of the terrain (ISO 9613-2, Equation 12) should be limited to a reduction of no more than 2 dB, and then only if there is no direct line of sight between the highest point on the turbine rotor and the receiver location.*
- *A further correction of +3 dB should be added to the calculated overall A-weighted noise level for propagation across a concave ground profile."*

2.2.4 On the application of directivity factors, the IOA GPG states that: *"based on evidence from the Joule project*[1] *in conjunction with advice in BS 8233 and ISO 9613-2, current practice suggests that for a range of headings from directly downwind (0 °) up to 10 degrees from crosswind (80 °), there may be little to no reduction in noise levels; once in crosswind directions (90 °) then the reduction may be around 2 dB(A); and when at sufficient distance upwind the reduction would be at least 10 dB(A). For intermediate directions between crosswind to upwind, a simple linear or polynomial interpolation*

[1] Bass J H, Bullimore A J. Development of a Wind farm Noise Propagation Prediction Model. JOR3-CT95-0091

can be used. Such reductions (due to "shadow zone" refraction effects) will in practice only progressively come into play at distances of between 5 and 10 turbine tip heights."

2.2.5 Subsequently to the publication of the IOA GPG, the IOA issued 6 Supplementary Guidance Notes (SPG) in July 2014 and September 2014 which supplement the above main guidance document (IOA 2013). The supplementary guidance notes provide advice on a number of issues and are summarised below:

- SPG 1 – Data collection,
- SPG 2 – Data processing & derivation of ETSU-R-97 background curves,
- SPG 3 – Sound power level data,
- SPG 4 – Wind shear,
- SPG 5 – Post completion measurements, and
- SPG 6 – Noise propagation over water for on-shore wind turbines.

2.2.6 The IOA GPG presents current good practice in the application of the ETSU-R-97 assessment methodology for all wind turbine developments above 50 kW, reflecting the original principles within ETSU-R-97, and the results of research carried out and experience gained since ETSU-R-97 was published. Accordingly, where relevant, the adopted noise assessment methodology for the Proposed Development follows the guidance contained in the IOA GPG, and is noted in the relevant sections of the Assessment Method section of Chapter 8: Noise (EIAR Volume 2a).

3. Amplitude Modulation (AM) of Aerodynamic Noise

3.1.1 Wind turbine AM noise tends to occur only under certain meteorological conditions and is likely to manifest at only a minority of wind farms. Two forms of Amplitude Modulation of wind turbine aerodynamic noise have been identified, namely, 'Normal' Amplitude Modulation (NAM) and 'Other' Amplitude Modulation (OAM).

3.1.2 Salford University's 2007 report 'Research into Aerodynamic Modulation of Wind Turbine Noise' stated that out of 133 operational wind farms investigated, AM was considered to be a factor in noise complaints at only four locations and a possible factor in a further eight locations. Furthermore, of the four sites where AM was considered to be a factor in noise complaints further investigation showed that the meteorological conditions associated with AM only occur between about 7% - 15% of the time.

3.1.3 Subsequently RenewableUK, in conjunction with others, has undertaken research to establish causal mechanisms of OAM and develop mitigation measures that can be applied should OAM be found to arise.

3.1.4 In December 2013, RenewableUK published information relating to amplitude modulation of aerodynamic noise. Their report explains the differences between NAM, and OAM. As a result of the

research, acoustics professionals and the wind industry have a clearer understanding of the characteristics of OAM, as well as how to address it if it should occur.

3.1.5 The RenewableUK OAM research found that:

- "significant *wind shear and wind turbulence can cause changes in the angle at which a wind turbine blade comes into contact with the wind (the angle of attack of turbine blades) as they rotate through each 360 degree cycle*;
- *in more extreme cases, these changes can push the blades into partial stall over part of their rotation*;
- *in such conditions of partial blade stall, OAM can occur*;
- *this OAM will likely be experienced in the far field but not necessarily in the immediate vicinity of the turbine; and*
- *practical mitigation strategies exist, including the use of individual cyclical pitch control, which could reduce the risk of stall, while minimising any loss in energy yield."*

3.1.6 It states in paragraph 7.2.1 of the IOA GPG "*the evidence in relation to "Excess" or "Other" Amplitude Modulation (AM) is still developing. At the time of writing, current practice is not to assign a planning condition to deal with AM"*.

3.1.7 Since the publication of the IOA GPG, the IOA has set up an AM working group (AMWG) to perform research into potential metrics for defining whether a sample of wind turbine noise exhibits amplitude modulation. The AMWG published its research in August 2016[2], which stated:

"The AMWG does not propose any limits for amplitude modulation. The purpose of the group is simply to use existing research to develop a Reference Methodology for the measurement and rating of amplitude modulation. The definition of any limits of acceptability for AM, or consideration of how such limits might be incorporated into a wind farm planning condition, is outside the scope of the AMWG's work and is currently the subject of a separate Government-funded study."

3.1.8 The UK Government Department of Energy and Climate Change (since merged into the Department for Business, Energy and Industrial Strategy (BEIS)) commissioned a review of the subjective response to AM, with the aim of identifying a method for controlling excessive AM suitable for use as part of the planning regime. The report, published in October 2016, recommends the use of a planning condition which applies a character penalty to the overall noise level to account for AM during periods of complaint. This penalty is based on the IOA AMWG methodology for detecting AM and the most up-to-date research on the relationship between annoyance and levels of AM within wind turbine noise. This penalty scheme has not been endorsed by any UK government and was not included as a planning condition for the Consented Development.

[2] Institute of Acoustics (2016). 'IOA Noise Working Group (Wind Turbine Noise) Amplitude Modulation Working Group Final Report A Method for Rating Amplitude Modulation in Wind Turbine Noise'

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Appendix 8.2: Baseline and Predicted Noise Data

Appendix 8.2 Baseline and Predicted Noise Data

1.1.1 This Technical Appendix presents a description of the baseline monitoring and the baseline and predicted noise level data used in the assessment of turbine noise presented in Chapter 8: Noise (EIAR Volume 2a).

1.1.2 The operational noise screening exercise presented in Chapter 8: Noise (EIAR Volume 2a) identified that baseline noise data were required at the High Clachaig and Low Clachaig NSRs. These NSRs are assumed to be represented by the measurement location at High Crubasdale from the 2016 EIA. The monitoring procedures from the 2016 EIA, including a description of the High Crubasdale monitoring location, is provided below.

1.1.3 For the purposes of this assessment, the background noise information for the remaining screened-in NSRs have been adopted from the sources listed below. These background noise levels have been corrected to refer to the wind speed at a standardised 10 m from the Proposed Development hub height and noise level limits have been derived, as shown in Figure 5 to Figure 8:

- Garvalt Building Plot: Background noise data sourced from the noise chapter of the Blary Hill Wind Farm EIA, noise monitoring at Upper Barr Farm,
- The Braids: Background noise data sourced from Environmental Statement for the proposed Killean Wind Farm noise monitoring at Culfuar.

1.1.4 The noise monitoring location can be seen in Figure 8.1 (EIAR Volume 2b). Concurrent wind speed and wind direction data were also measured at the Development Site. The wind speed was measured using a single mast with eight anemometers installed at 80 m, 78 m, 75 m, 60 m, and 40 m (two anemometers at heights of 78 m, 60 m and 40 m: one north facing the other south facing). The wind direction was measured at heights of 80 m and 48 m. For the purposes of deriving the standardised 10 m wind speeds, the anemometers installed at 80 and 40 m have been used to identify hub height wind speed; in accordance with method (b) detailed on page 10 of the IOA (2013) GPG. As the Proposed Development hub heights have changed from those for the Consented Development, the background noise level limits (which are referenced to hub height wind speed standardised to 10 m) have also changed since the 2016 EIA. The wind vane installed at 80 m was used to determine the wind direction.

1.1.5 With regards to background noise monitoring ETSU-R-97 states "*it is expected that to avoid the results being weighted by unrepresentative conditions at least 1 weeks' worth of measurements will be required. The actual duration will depend upon the weather conditions, in particular the strength and direction of the wind that has blown during the survey period and the amount of rain".* Although there were periods of rain during the measurement period, the 10-minute measurement periods for which rain occurred have been excluded during the data analysis process to determine background noise levels at integer wind speeds. This assessment considerably exceeds the minimum recommended time frame for data collection.

1.1.6 Furthermore, Summary Box 12 of the IOA (2013) GPG states that "*the survey duration is determined entirely by the requirement to collect sufficient valid data over an adequate range of wind speeds. For pitch-regulated turbines, data should cover the range of wind speeds between cut-in and the speed at which maximum sound power level is achieved. As a guideline, no fewer than 200 valid data points should be recorded in each of the amenity hours and night time periods, with no fewer than 5 valid data points in any 1 m/s wind speed bin.*" Analysis of the data showed that this requirement was met.

1.1.7 The equipment and coordinates for each measurement location used for the background noise level surveys are detailed in **Error! Reference source not found.**.

Table 1 Noise Monitoring Location

Location	Equipment	Coordinates (on the British National Grid) of measurement location[8.1]	
		Easting	Northing
High Crubasdale	Rion NL-52 Sound Level Meter s/n: 01021280 Rion UC-59 Microphone s/n: 04336	169058	640638
All	Rion NC-74 calibrator s/n: 34425539	N/A	N/A

1.1.8 The microphone was fitted with a Rion WS-15 dual-skinned windshield which is compliant with the requirements of the IOA (2013) GPG and the IOA GPG Supplementary Guidance Note 1: Data Collection, as well as maintaining IEC 61672 Class 1 measurement accuracy.

1.1.9 The microphone was positioned at 1.5 m above local ground level and were located in positions that were deemed to be representative of the background noise at the property in question, away from obvious localised sources of noise such as boiler flues and running water.

1.1.10 Each sound level meter logged the $L_{A90,10min}$ and $L_{Aeq,10min}$ sound levels during the measurement periods.

1.1.11 The noise level meters were field calibrated on deployment. Field calibration checks, data download and battery changes took place every 14 to 15 days. No drifts greater than 0.1 dB in field calibration were found for either of the sound level meters from one visit to the next.

1.1.12 All noise monitoring equipment was subject to a certificate of calibration traceable to appropriate national and international standards as required by ETSU-R-97.

1.1.13 The noise climate at each location was subjectively assessed during installation and decommissioning of noise monitoring equipment, as well as during site visits; these are summarised below in the Noise Survey Monitoring Location section.

1.1.14 The wind speed and direction data were averaged over the same concurrent ten minute sampling periods as the noise data.

[8.1] The presented co-ordinates are the approximate easting and northing locations of the noise monitoring equipment.

1.1.15 Hourly precipitation data was obtained from The Met Office by derivation from radar imagery, which is an acceptable method within the IOA (2013) GPG.

1.1.16 Noise and wind data collected during periods of rain have been excluded from the data used to determine the background noise level as a function of wind speed. As the rain data are in hourly periods, every 10 minute period in an hour when rain occurred has been excluded.

1.1.17 Manual exclusions of the noise data were also undertaken to remove data that was considered atypical, such as where rises in noise levels did not correlate with rises in wind speeds and periods when the dawn chorus caused rises in the noise level during the night-time period, in accordance with the advice contained within the IOA (2013) GPG.

1.2 Noise Survey Monitoring Locations

1.2.1 The monitoring location was agreed in advance with the EHO for ABC for the original consent and those locations were also accepted through the scoping exercise of the revised scheme. The EHO was consulted throughout the background noise monitoring location selection process. The EHO advised on 30 November 2015 via e-mail correspondence that one monitoring location would be suitable as a proxy for the following properties: Low Clachaig, High Clachaig and High Crubasdale.

High Crubasdale

1.2.2 The property High Crubasdale is located approximately 2.1 km from the closest turbine (Turbine Number 10).

1.2.3 The noise monitoring equipment was installed in the amenity area of High Crubasdale Farm, approximately 10 m from the northern facing façade of the property. The property is located within a working farm and thus the sound of machinery and farm animals were part of the baseline. The measurement location was chosen as it was the furthest amenity area from the kennels, farm machinery and cow shed.

1.2.4 Typically, the noise climate experienced at this location consisted farm machinery, livestock and dogs barking.

1.2.5 The noise and wind data for the baseline noise monitoring at High Crubasdale Farm are presented graphically in Figure 1 to Figure 4. Figure 1 and Figure 2 include predicted noise levels at High Clachaig, Figure 3 and Figure 4 include those at Low Clachaig. Figure 1 and Figure 3 relate to the quiet daytime period (18:00 - 23:00 Monday to Sunday, 13:00 - 18:00 Saturday and 07:00 to 18:00 Sunday), whilst Figures 2 and 4 relate to the night-time period (23:00 - 07:00). Each graph presents the following information:

- The standardised 10 minute average wind speed as a function of the measured 10 minute average wind direction,
- The measured 10 minute L_{A90} sound pressure level as a function of the standardised 10 minute average wind speed. In addition, a polynomial fit has been applied. The coefficients of the polynomial fit are also presented in the corner of the graph, and
- The derived noise level limits and predicted Proposed Development turbine noise levels.

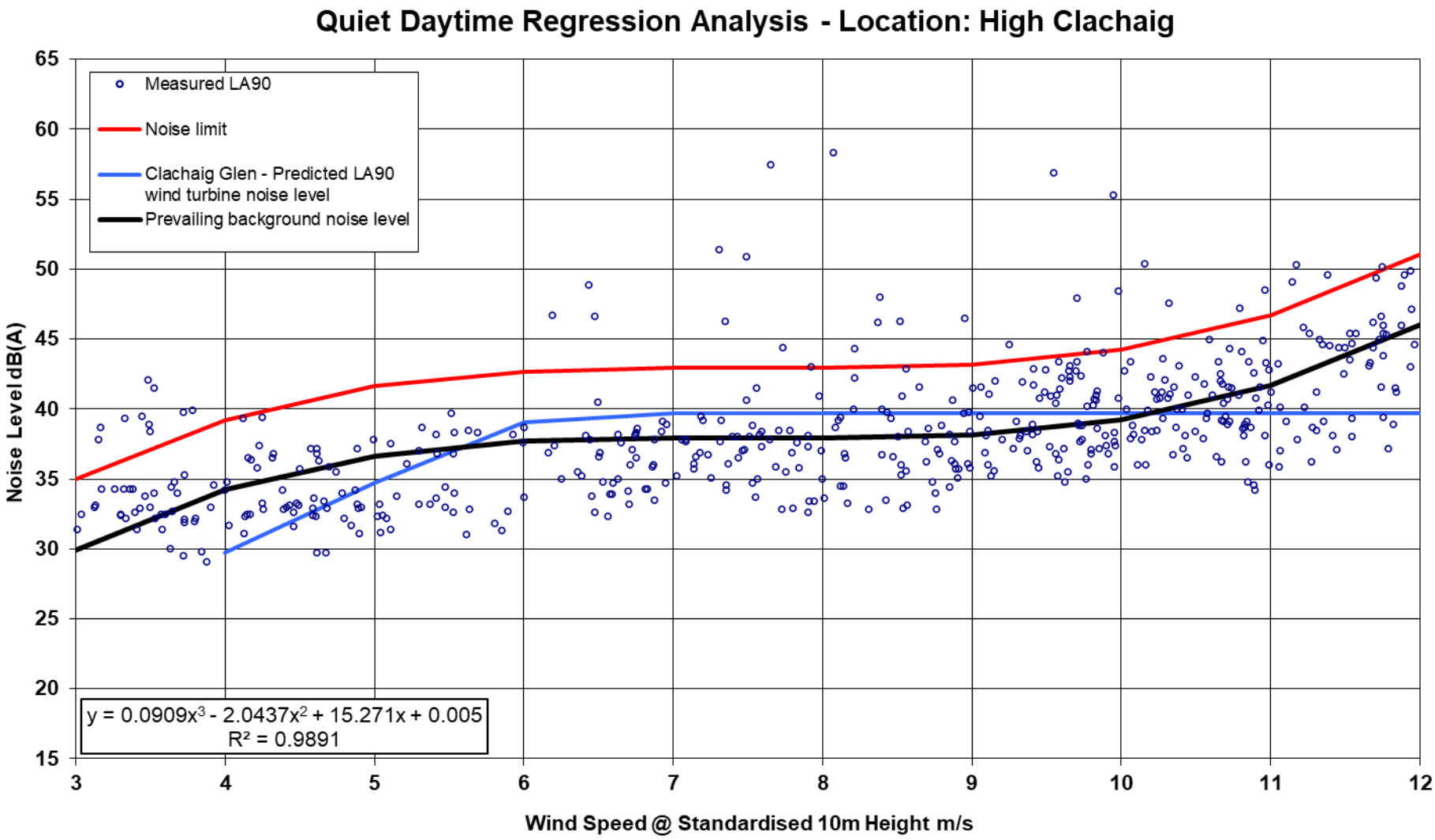

Figure 1 Quiet Daytime Regression Analysis, High Clachaig

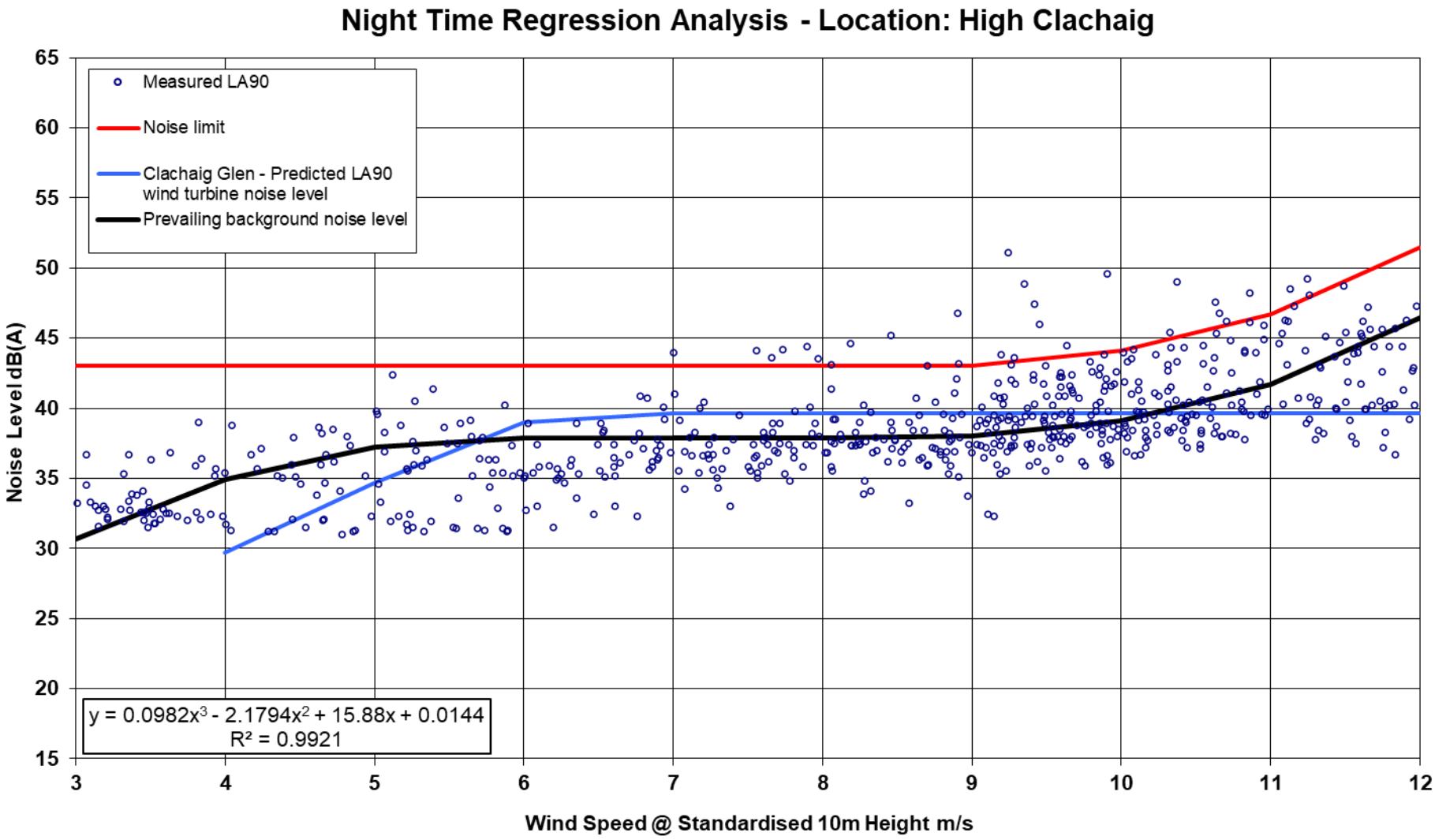

Figure 2 Night-time Regression Analysis, High Clachaig

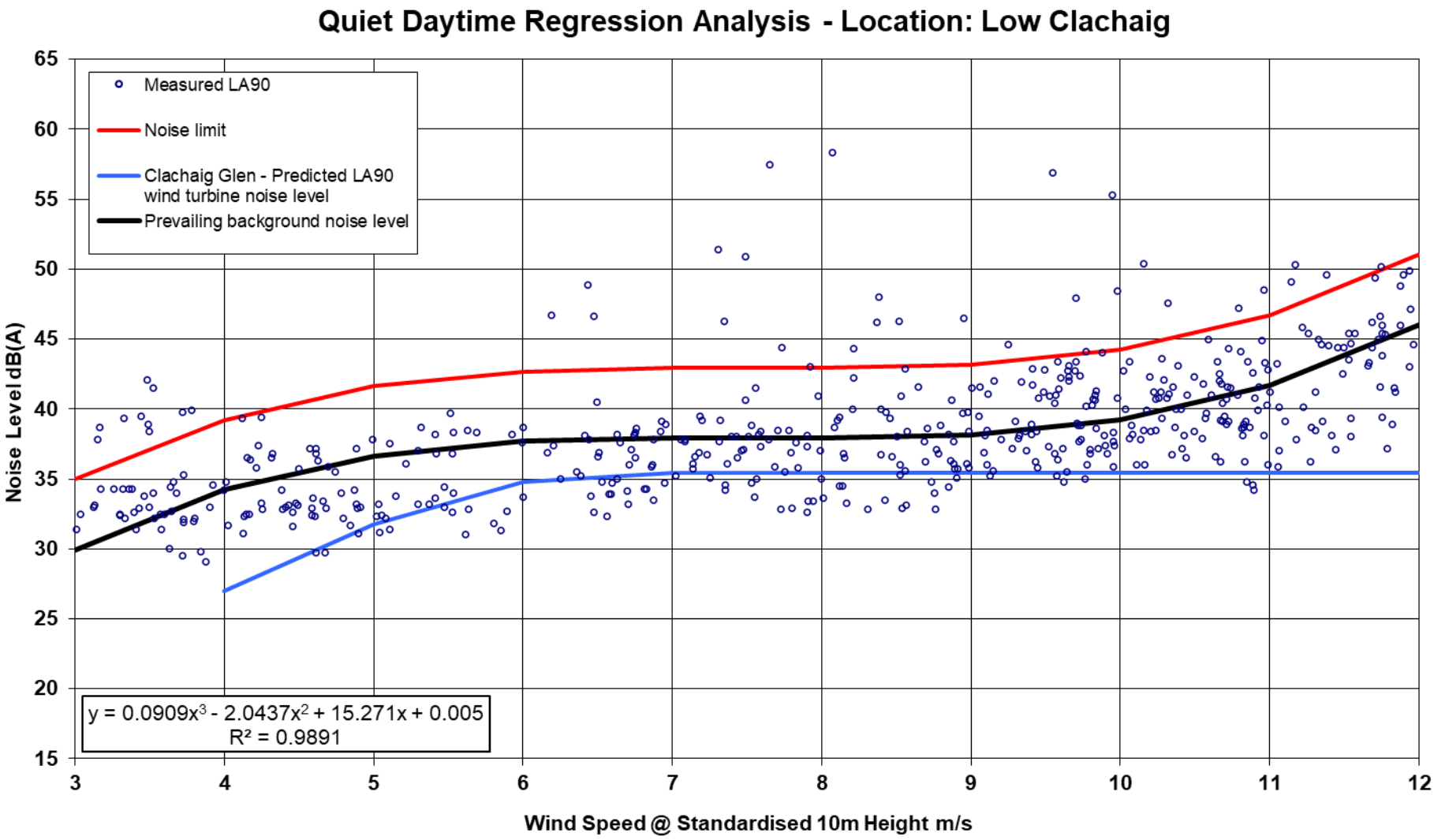

Figure 3 Quiet Daytime Regression Analysis, Low Clachaig

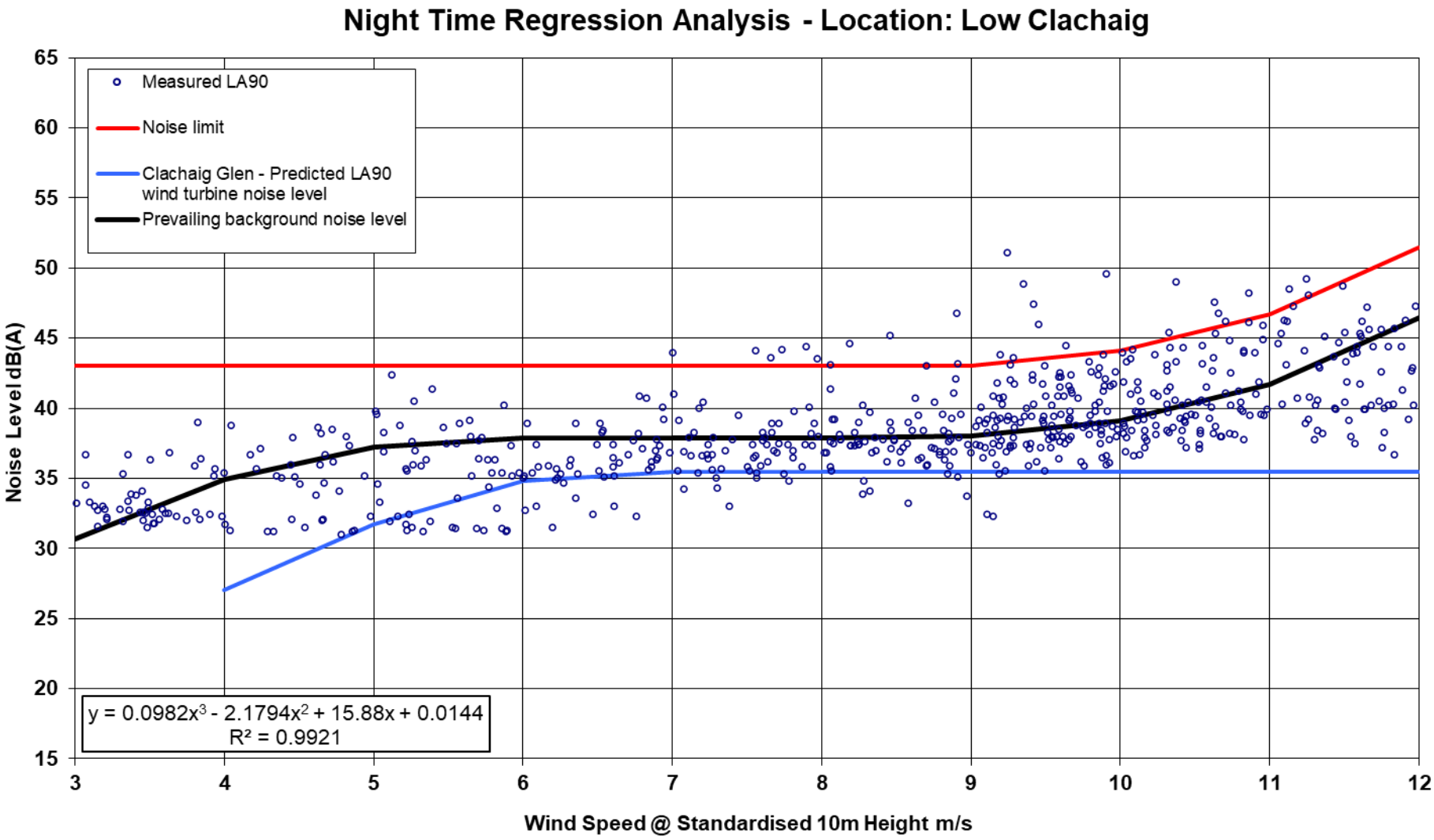

Figure 4 Night-time Regression Analysis, Low Clachaig

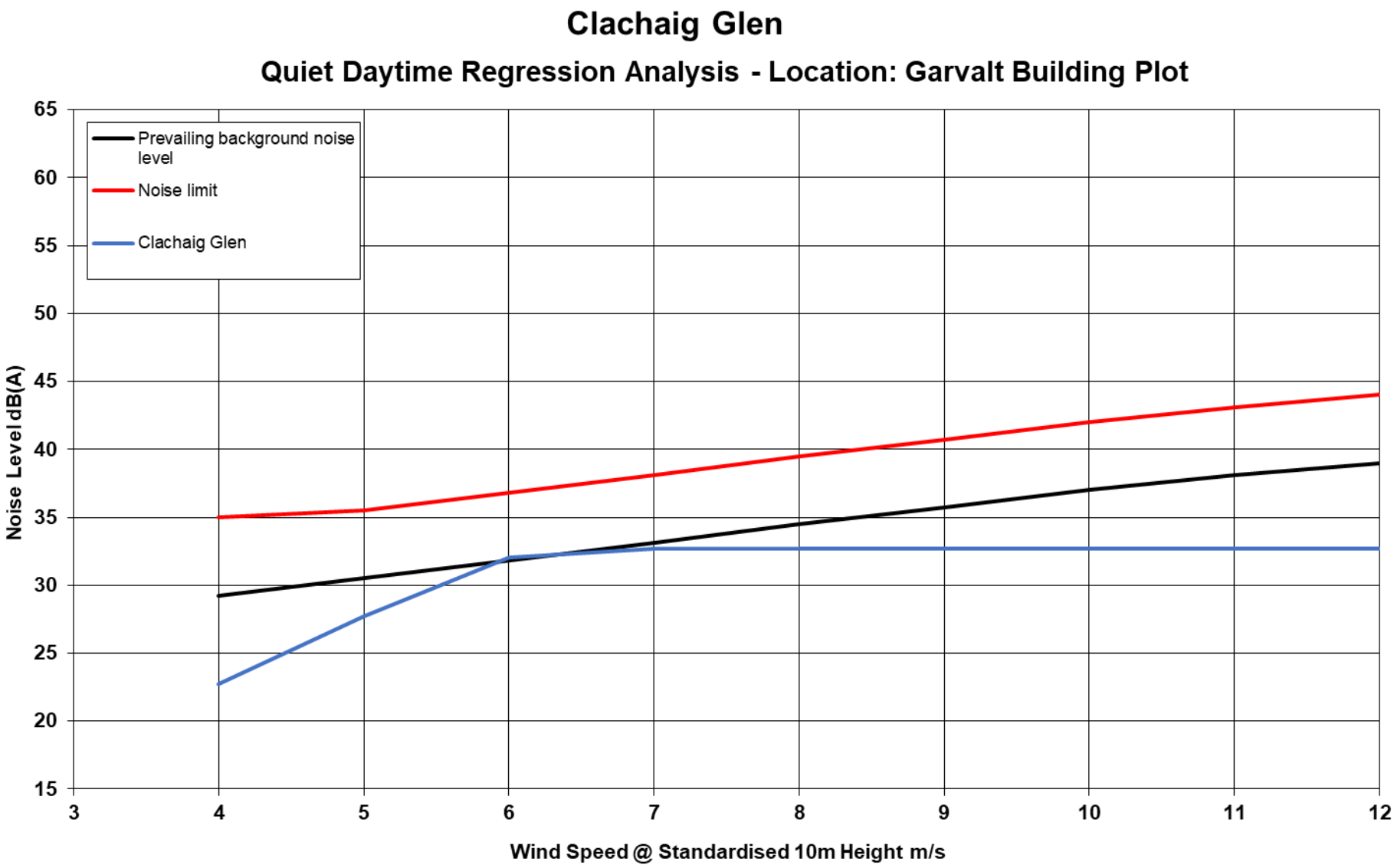

Figure 5 Quiet Daytime Regression Analysis, Garvalt Building Plot

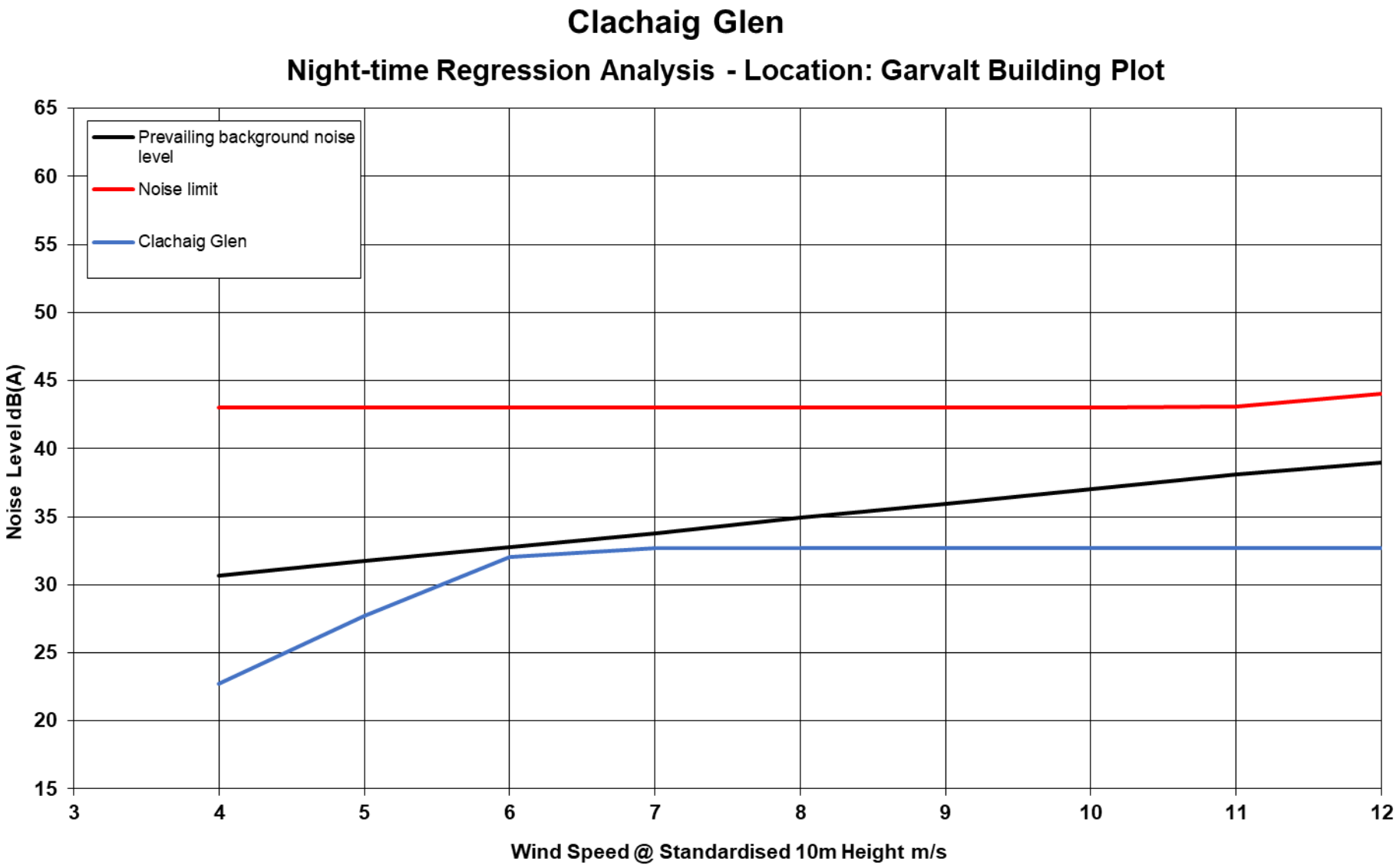

Figure 6 Night-time Regression Analysis, Garvalt Building Plot

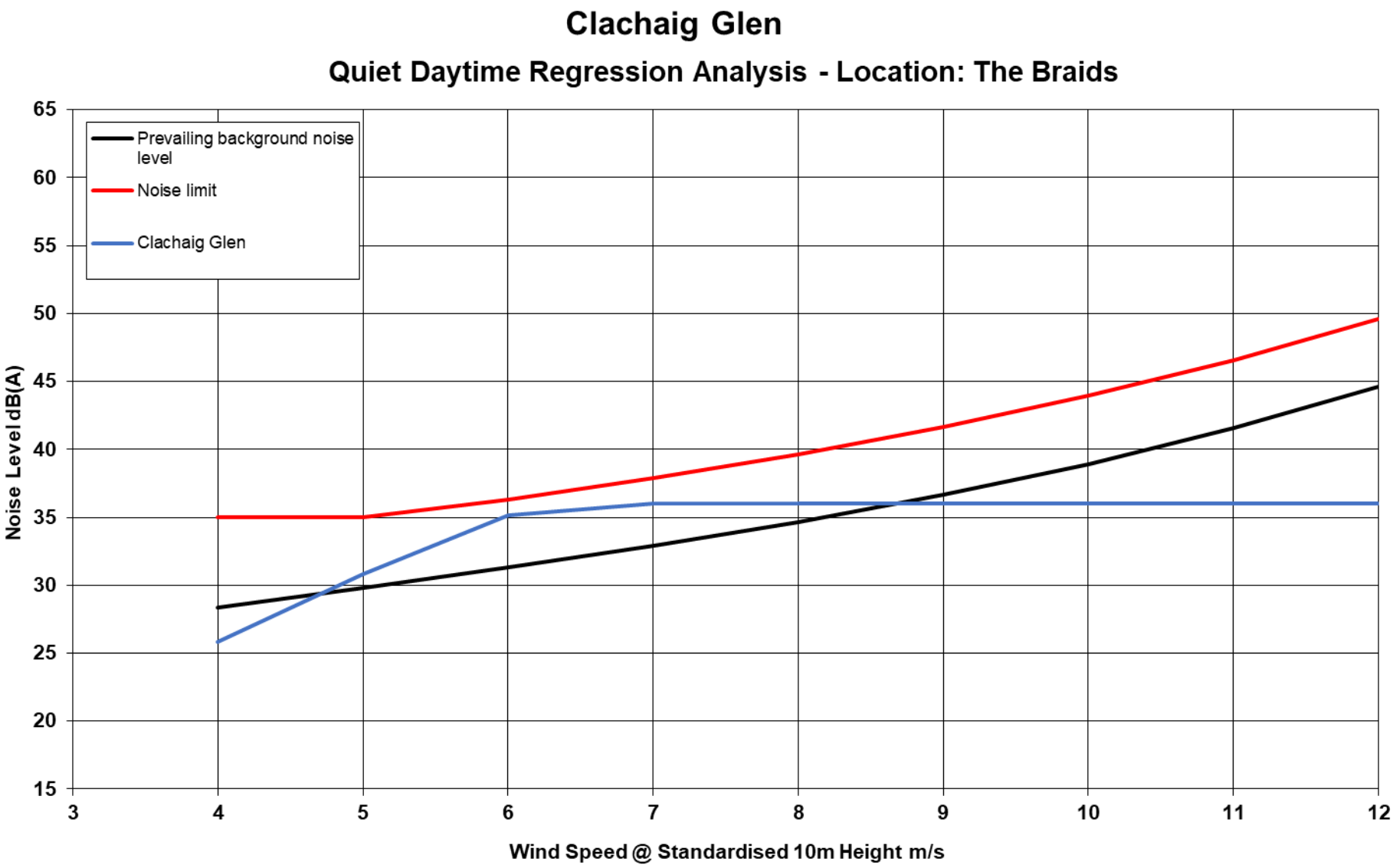

Figure 7 Quiet Daytime Regression Analysis, The Braids

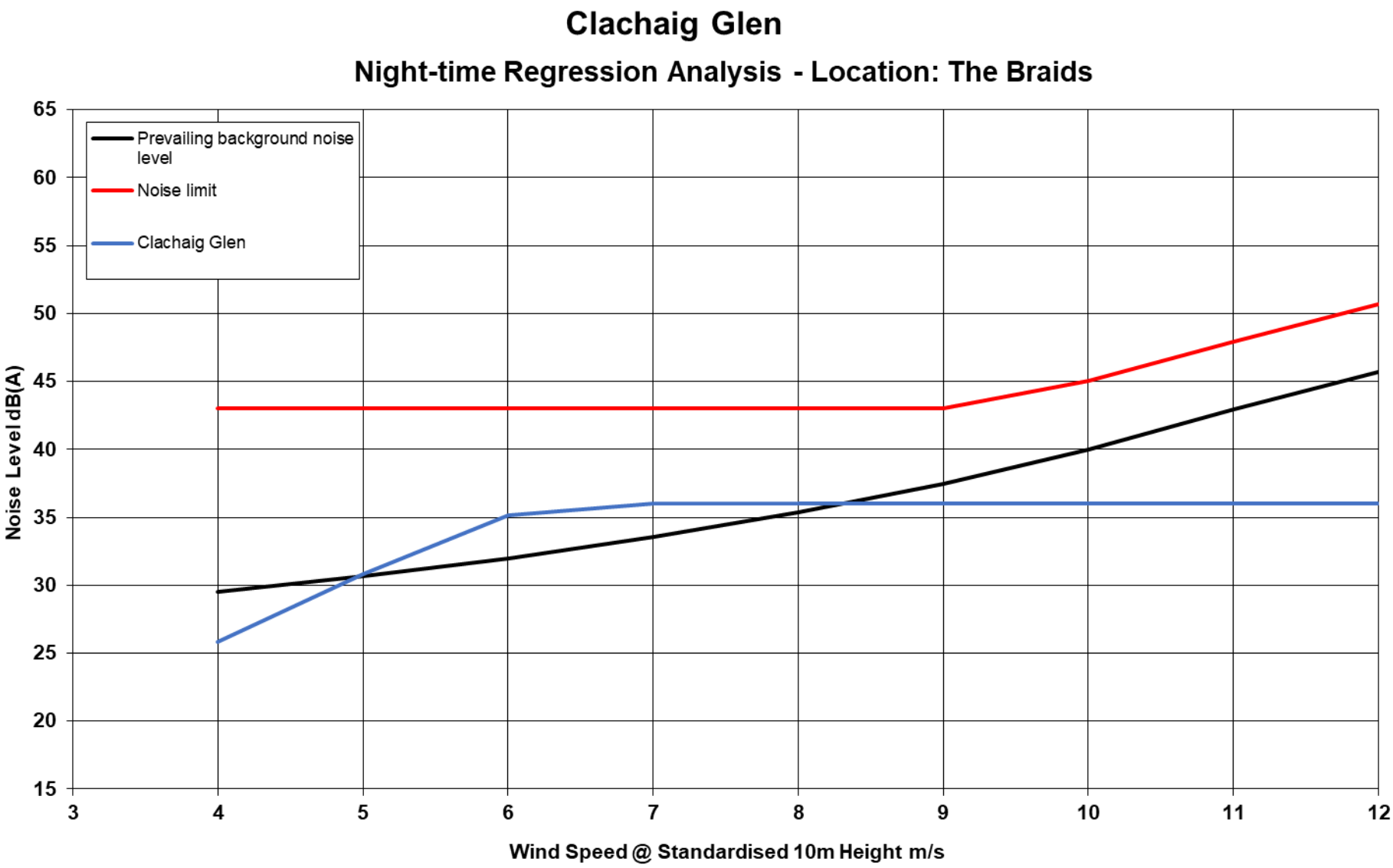

Figure 8 Night-time Regression Analysis, The Braids

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Appendix 8.3: Turbine Prediction Details

Appendix 8.3 Turbine Prediction Details

1.1.1 This Technical Appendix provides additional details on the turbine predictions. It provides evidence for the existing / proposed turbine sound power level data used in the noise level predictions described in Chapter 8: Noise (EIAR Volume 2a). It describes the uncertainty corrections applied, which depend on the source of the data for each turbine type. The decision as to what uncertainty correction to apply has been based on the guidance in the IOA GPG Supplementary Guidance Note 3: Sound Power Level Data.

1.1.2 For each wind farm considered in the predictions of the cumulative noise levels, the turbine type has been identified and the sound power levels sourced from a combination of published manufacturer's data or the noise assessments which have accompanied planning applications for wind farms incorporating that turbine type. This information is provided for each turbine type in Table 1.

1.1.3 Table 2 shows the NSRs included in the assessment and identifies, for each Proposed Development turbine, the applied screening correction in the predictions. No NSR / Proposed Development turbine pairs were identified at which the concave ground correction should be applied.

Table 1 Existing / proposed turbine sound power level data

Turbine Type	Wind Farm	Data Source	Additional Uncertainty Correction
Vestas V80	Auchadaduie	West Cape Wind Farm Environmental Noise Impact Report September 2006[1]	Document does not describe uncertainty therefore 2 dB additional uncertainty correction added to presented values.
Vestas V66	Deucheran Hill	Vestas. Noise Curve V66-1.75MW 78m hub height. Doc Date: 24 October 2000	Document presents “theoretical calculated noise curve” which is indicated to have +/- 2 dB(A) accuracy; hence, a further 2 dB has been added to the stated levels in the document to account for uncertainty.
Nordex N90	Blary Hill	Nordex N90/2500 HS Noise levels. Doc No F008_149_A03_EN July 2007.	Document presents manufacturer’s warranted sound power levels which account for uncertainty; hence, provided values are used directly.
Vestas V47	Beinn an Tuirc	Noise Assessment, Harrington Parks Farm, Land West of Harrington Parks Farm, Cumbria[2]	Document presents manufacturer’s specified noise level with 2 dB uncertainty correction added; hence, provided values are used directly.
Siemens SWT82 2.3	Beinn an Tuirc Extension	Siemens. Acoustic Emission, SWT-2.3-82 VS, 80m hub height	Document presents manufacturer’s warranted sound power levels which account for uncertainty; hence, provided values are used directly.
Siemens SWT-2.3-93	Beinn an Tuirc Phase III	Tangy IV Wind Farm Noise Assessment, which references Siemens Document PG-03-10-0000-0066-01 BSN,HST, 12/07/2006[3]	Document presents manufacturer’s warranted sound power levels which account for uncertainty; hence, provided values are used directly.
Senvion MM92	Cour	REPower Systems. Power Curve & Sound Power Level REpower MM92[2050 kW]. Document-No.: SD-2.9-WT.PC.03-B-C-EN. Date: 2010-10-19[4]	Document states: The sound power level guaranteed by REpower includes a measurement uncertainty of approx. 1 dB(A). Hence, a further 1 dB has been added to the stated levels in the document to account for uncertainty.
Vestas V27	Isle of Gigha	Roundshaw Farm Single Wind Turbine Environmental Statement[5]	Document presents the data supplied by the manufacturer and adds 3 dB to “account for the maximum measurement uncertainty provided by the manufacturer”. The data with the 3 dB uncertainty correction have been used.

[1] Available at http://www.gov.pe.ca/photos/original/appenJwcII.pdf
[2] Available at http://windland.ch/doku_wind/noise/Noise_Harrington_Parks_Farm.pdf
[3] Available at https://portal360.argyll-bute.gov.uk/civica/Resource/Civica/Handler.ashx/Doc/pagestream?cd=inline&pdf=true&docno=21886102
[4] Available at http://ventderaison.eu/estaimpuis/estaimpuis_eie_windvision_2012/Annexes/Annexe_S1_Courbes_acoustique_MM92,_E-82_E2,_V100.pdf
[5] Available at https://docs.east-ayrshire.gov.uk/crpadmmin/2012%20agendas/local%20review%20body/15%20january%202015/roundshaw%20farm%20-%20enviromental%20statement%20volume%203.pdf

Turbine Type	Wind Farm	Data Source	Additional Uncertainty Correction
Enercon E33	Leim Farm, Gigha	Enercon. Sound Power Level of the ENERCON E-33 Operational Mode I (Data Sheet). Document name: SIAS-04-SPL E-33 OM I Rev1_0-eng-eng.doc Revision /date: 1.0 / July 2010	Document states that measured sound levels can differ from stated by ±1 dB; hence, 1 dB added to presented data.
Nordex N133 4.8 MW	High Constellation	High Constellation Wind Farm Environmental Statement[6]	2 dB uncertainty correction incorporated into presented data, hence used directly.
Vestas V150 5.6 MW	Narachan	Narachan Wind Farm Environmental Statement[7]	2 dB uncertainty correction incorporated into presented data, hence used directly.

Table 2 Applied Screening Corrections

NSR	Turbine Number											
	1	2	3	4	5	6	7	8	10	11	13	14
High Crubasdale	0	0	0	0	0	0	0	0	0	0	0	0
North Crubasdale	0	-2	0	0	-2	0	-2	0	0	0	-2	0
South Beachmore	0	-2	0	0	-2	0	-2	0	0	0	-2	0
North Beachmore	-2	-2	0	0	-2	0	-2	0	0	0	-2	0
Beachmanach	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
Beacharr	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
Various properties, Arnicle	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
High Clachaig	0	0	0	0	0	0	0	0	0	0	0	0
Low Clachaig	0	0	0	0	0	0	0	0	0	0	0	0
Garvalt Building Plot	-2	0	-2	-2	0	0	0	-2	-2	0	0	0
The Braids	0	0	0	0	0	0	0	0	0	0	0	0

[6] Available at https://portal360.argyll-bute.gov.uk/planning/planning-documents?SDescription=19/01182/S36
[7] Available at https://portal360.argyll-bute.gov.uk/planning/planning-documents?SDescription=20/00212/S36

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Appendices

Appendix 9.1: Method for Assessment of Ecological Impacts

Appendix 9.1 Method for Assessment of Ecological Impacts

1. Introduction

1.1.1 This Appendix serves as accompanying information to Chapter 9: Ecology and Chapter 10: Ornithology of the Environmental Impact Assessment Report (EIAR) (Volume 2a). Throughout this Appendix, the term 'ecological feature' refers to all designated sites, habitats and species relevant to Chapters 9 and 10, including ornithological features.

1.1.2 The assessment of potential impacts from the Proposed Development on ecological features broadly follows the guidelines for Ecological Impact Assessment (EcIA) published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018). These guidelines have been endorsed by, amongst others, the Institute of Environmental Management and Assessment (IEMA), the Wildlife Trusts, the Association of Local Government Ecologists (ALGE) and NatureScot (formerly Scottish Natural Heritage (SNH)). The principal steps are summarised below:

- Baseline conditions are determined through targeted desk study and field survey to identify ecological features that are both present and might be affected by the Proposed Development (both those likely to be present at the time works begin, and for comparison, those predicted to be present at a set time in the future),
- The importance of identified ecological features is evaluated to place their relative biodiversity and nature conservation value into a geographic context, determining those that need to be considered further within the impact assessment,
- The potential impacts of the Proposed Development on relevant ecological features are described, taking into account established best practice, legislative requirements and embedded design measures,
- The likely effects (adverse or beneficial) on relevant ecological features are assessed, and where possible quantified,
- Measures to avoid or reduce (or, if necessary, compensate) any predicted significant effects, if possible, are developed in conjunction with other elements of the design (including mitigation for other environmental disciplines),
- Any residual effects of the Proposed Development and their significance are reported, and
- Scope for enhancement measures is considered.

1.1.3 Throughout the assessment, the professional judgement of experienced ecologists is applied as necessary.

2. Assessing the Importance of Ecological Features

2.1.1 An ecological feature is a designated site, habitat, or species or ecosystem of nature conservation importance.

2.1.2 Only those ecological features that are 'important' and that could be significantly affected by the Proposed Development require detailed assessment – "*it is not necessary to carry out detailed assessment of ecological features that are sufficiently widespread, unthreatened and resilient to project impacts and will remain viable and sustainable*" (CIEEM, 2018). This is consistent with The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017, which require investigation of likely significant effects.

2.1.3 Existing data and criteria are considered when determining the importance of ecological features. Where these are lacking, it is necessary to apply professional judgement. Factors considered include:

- rarity, endemicity, mobility and geographic range (particularly if this changing),
- size / extent, rate of decline and vulnerability,
- typicalness, species-richness, habitat structure and connectivity / fragmentation,
- function / value to other features (e.g. habitats of notable species or buffers against impacts), and
- restoration potential.

2.1.4 Requirements to comply with legislation are stated during the assessment, but legislative protection or priority listing (e.g. within a Local Biodiversity Action Plan) does not necessarily translate to importance. For example, a transitory roost of a single bat would not be afforded the same importance as a regularly-occurring maternity roost (although legal obligations must still be met), and areas of priority habitat could be unfavourably small or in poor condition and not practically restorable.

2.1.5 The importance of ecological features is described within a geographic scale. In this assessment, the importance of ecological features has been translated from CIEEM categories to conform with the terminology used throughout the Environmental Impact Assessment (EIA). The term 'value' is consequently used hereafter as a surrogate for 'importance' to ensure consistency with the rest of the EIA. Examples of the types of ecological features which might fall into various valuation categories are given in Table 1, which is adapted from CIEEM (2018).

2.1.6 For the purposes of this assessment, the geographical level of 'Regional' is defined as the area encompassed by the Argyll West and Islands Natural Heritage Zone (NHZ), 'Local' as the Kintyre Peninsula between the Mull of Kintyre and Tarbert, and 'Site' as the area within the red line boundary of the Proposed Development.

Table 1 Value of Ecological Features

Value[1]	Examples of Types of Ecological Feature
Very High (International)	• Internationally designated site (or candidate / proposed international site), or site satisfying criteria for such designation, or feature essential to maintaining such sites. • Sustainable area (or part of a larger sustainable area) of best examples of Annex I habitat[2]. • A regularly-occurring internationally-significant population (e.g. 1% of the international population, or potentially less for critical parts of wider populations or those at a critical life-cycle stage) of internationally important species listed on Annex I of the Birds Directive or Annex II of the Habitats Directive. • A site supporting a regularly-occuring internationally significant population.
High (National)	• Nationally designated site (or proposed site), or site satisfying criteria for such designation. • Sustainable area of good quality Annex I habitat not deemed to be of international importance, or of a national priority habitat, which is a significant proportion of the national resource. • Regularly-occurring nationally significant population (e.g. 1% of the national population, or potentially less for critical parts of wider populations or those at a critical life-cycle stage) of species protected under national legislation or identified as being of national importance for conservation (e.g. through listing on the Scottish Biodiversity List (SBL)). • A site supporting a regularly-ocurring nationally significant population.
Medium (Regional)	• Regionally designated nature conservation site (or proposed such site). • Sustainable area of Annex I habitat or national priority habitat not deemed to be of higher importance (e.g. lower quality, highly fragmented, small and/or low restoration potential). • Regularly-occurring regionally significant population (e.g. 1% of regional resource, or potentially less for critical parts of wider populations or those at a critical life-cycle stage) of species protected by legislation or identified as being a regional priority for conservation (e.g. through a Local Biodiversity Action Plan). • A site supporting a regularly-ocurring regionally significant population.
Low (Local)	• Priority habitat of insufficient size or quality for higher importance, or degraded with low restoration potential. • Habitat providing significant biodiversity or important ecological corridors in a local context. • Small sustainable population of notable species not qualifying for higher importance or uncommon locally.
Negligible (Site)	• Common, heavily managed or modified habitat. • Common and widespread species.

[1] 'Value' is used here as a surrogate for for the term 'importance' adopted by CIEEM (2018). The value categories used are consistent with the other chapters of this EIAR. Corresponding CIEEM importance categories are provided in brackets.

[2] Habitat listed on Annex I of Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive').

[3] Bird species listed on Annex I of Directive 2009/147/EC on the conservation of wild birds (the 'Birds Directive').

3. Describing Potential Impacts and Effects

3.1.1 Impacts may occur during the construction, operation and decommissioning phases of a development. They may be direct or indirect (also termed 'secondary'). Direct impacts are attributable to an action associated with a development. Indirect impacts are often produced away from a development or as a result of other initial impacts.

3.1.2 Likely impacts are characterised using those parameters below that are necessary to understand them:

- Direction – whether the impact will have a beneficial or adverse effect,
- Magnitude – the 'size', 'amount' or 'intensity' of an impact, described in quantitative terms as far possible,
- Extent – the spatial or geographical area or distance over which the impact or effect occurs,
- Duration – the time over which an impact is expected to last prior to recovery or replacement (if possible) of the resource or feature. Where appropriate, ecological aspects such as lifecycles are considered. The duration of an effect may be longer than the duration of an activity or impact,
- Timing and frequency – timing is important since an impact might not occur if it avoids critical seasons or life stages. Frequency considers activity repetition, which may have greater impact, and,
- Reversibility – whether the impact is temporary or permanent. A temporary impact is one from which recovery is possible or for which effective mitigation is possible and enforceable. A permanent impact is one from which recovery is either not possible, or cannot be achieved within a reasonable timescale (in the context of the feature being assessed).

3.1.3 Published studies, guidance and/or professional judgement is used to quantify the magnitude of impacts using the criteria described in Table 2.

Table 2 Criteria for Determining Magnitude

Magnitude	Definition
High	Total loss or major alteration to key elements / features of the baseline conditions such that post-development character / composition will be fundamentally changed.
Medium	Loss or alteration to one or more key elements / features of the baseline conditions such that post-development character / composition will be materially changed.
Low	Minor shift away from baseline conditions. Changes arising from the alteration will be detectable but not material. The underlying character / composition of the baseline condition will be similar to the pre-development situation.
Negligible	Very little change from baseline conditions. Change is barely distinguishable, approximating to a 'no change' situation.

3.1.4 Magnitude is independent of the value of an ecological feature. Impacts / effects can be temporary or permanent, of varying duration (short-term being less than five years, medium-term being between five and 15 years, long-term being 15 to 25 years and permanent being more than 30 years), adverse or beneficial.

3.1.5 Consideration is given to conservation objectives, whether processes within sites will be altered, effects on habitats and species population size / viability, and whether these will have an effect on conservation status. NatureScot defines the conservation status of a species as "*the sum of the influences acting on it which may affect its long-term distribution and abundance, within the geographical area of interest*" (SNH, 2018). A species' conservation status is considered to be 'favourable' when:

- population dynamics indicate that the species is maintaining itself on a long-term basis as a viable component of its habitats,
- the natural range of the species is not being reduced, nor is it likely to be reduced for the foreseeable future, and
- there is (and probably will continue to be) a sufficiently large habitat to maintain its population on a long-term basis.

4. Determining Significance

4.1.1 Under CIEEM (2018) guidance there is a distinction between impact and effect. An impact is an action on an ecological feature (e.g. loss of a bat roost). An effect is the outcome of that impact on an ecological feature (e.g. effect of bat roost loss on the conservation status of the bat species).

4.1.2 An effect (positive or negative) is assessed by determining whether the ecological integrity of a site or ecosystem, or the conservation status of a species, will be affected at the geographic levels described in Paragraphs 2.1.5 and 2.1.6. An effect could occur at a lower geographic level than the value (importance) assigned to that particular ecological feature (for example, an effect on a habitat or population assigned national importance may be slight and not consequential at the national level). These assessments are based on quantitative evidence where possible, and as necessary through the professional judgement of experienced ecologists.

4.1.3 Initially, the assessment of effects does not consider mitigation (avoidance or reduction) or compensation measures, except where these are explicitly embedded into the design of the Proposed Development. The assessment of residual effects takes such measures into account, with the aim that, wherever possible, residual effects are not significant or are significant at a lower geographic level than the unmitigated effects.

4.1.4 The significance of an effect is largely a product of the value (importance) of the ecological feature and the magnitude of impact upon it (where magnitude encompasses all relevant parameters set out in Section 3, moderated by professional judgement. Table 3 provides the matrix for determining significance of ecological effects. The greater the ecological value or magnitude of impact, the more significant the effect.

4.1.5 Effects defined in Table 3 as Major or Moderate are considered to be significant in this assessment.

Table 3 Approach to Assessment of Effects

	Value				
Magnitude	**Very High**	**High**	**Medium**	**Low**	**Negligible**
High	Major	Major	Moderate	Moderate	Minor
Medium	Major	Moderate	Moderate	Minor	Negligible
Low	Moderate	Moderate	Minor	Negligible	Negligible
Negligible	Minor	Minor	Negligible	Negligible	Negligible

4.1.6 Consideration is given to cumulative effects, since effects acting in combination may have a cumulative effect exceeding that of the separate effects. Cumulative effects may arise from a combination of effects from the Proposed Development itself (e.g. effects at the construction and operation stages), or the combined effects from different developments.

5. References

- CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Version 1.1 – Updated September 2019. Chartered Institute of Ecology and Environmental Management, Winchester.
- Eaton, M., Aebischer, N., Brown, A., Hearn, R., Lock, L., Musgrove, A., Noble, D., Stroud, D. and Gregory, R. (2015). Birds of Conservation Concern 4: the population status of birds in the UK, Channel Islands and Isle of Man. British Birds 104: pp 708 – 746.
- SNH. (2018). Assessing Significance of Impacts from Onshore Windfarms on Birds out with Designated Areas. Version 2 – February 2018.

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Appendix 9.2: Zone of Influence for Ecological Features

Appendix 9.2 Zone of Influence for Ecological Features

1. The Zone of Influence

1.1.1 This Appendix accompanies Chapter 9: Ecology (EIAR Volume 2a). It sets out the 'zone of influence' (ZoI) for ecological features from the Proposed Development.

1.1.2 The ZoI of the Proposed Development is the area over which ecological features may be subject to significant effects as a result of its construction, operation, decommissioning and/or associated activities. The ZoI can extend beyond the boundary of the Proposed Development.

1.1.3 The ZoI will vary for different ecological features depending on their sensitivity to an environmental change. It is therefore appropriate to identify different ZoI for different features. As recommended by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018), professionally accredited or published studies and guidance, where available, were used to help determine the likely ZoI, as well as professional judgement. However, CIEEM (2018) also highlights that establishing the ZoI should be an iterative process and can be informed by further desk study and field survey. Where limited information is available, the precautionary principle was adopted and a ZoI estimated on that basis.

1.1.4 Considering the nature of the Proposed Development and having reviewed published literature, and based on the results of desk study and field survey carried out to establish the baseline conditions, a ZoI was estimated for each relevant ecological feature.

1.1.5 Relevant ecological features are those which were considered to be important in the context of this EIA and for which significant effects could have occurred as a result of the Proposed Development. Therefore, ZoI are not given for all features, including species, which were identified within or near to the Development Site. ZoI for certain ecological features were not estimated because they were not considered to be important and/or because the potential for significant effects on them could clearly be discounted prior to detailed impact assessment (see Chapter 9: Ecology, Section 9.6).

1.1.6 The ZoI adopted in this EIA are given in Table 1, below.

Table 1 Zone of Influence of the Proposed Development on Relevant Ecological Features

Ecological Feature	Adopted ZoI	Rationale
Internationally designated sites	10km	The zone of influence of a development for international sites, which for the ecology assessment (i.e. excluding ornithological sites which are addressed in the Chapter 10) primarily involves Special Areas of Conservation, is the geographical area over which it could affect the receiving environment in a way that could have significant effects on the interests of international sites. This should be established on a case-by-case basis using the Source-Pathway-Receptor framework. However, 10km has been employed in this case, the standard consideration distance employed in Scotland. There is no hydrological connection to any internationally designated site beyond 10km, except those in the marine environment, but at this distance and given the nature of the Proposed Development and size of the relevant open sea area, there is no possibility of adverse effects from pollution incidents at the Development Site. The Proposed Development does not involve stack emissions therefore this type of effect, which can occur over substantial distances, is not relevant. A review of the ecological effects of diffuse air pollution arising from road traffic commissioned by Natural England (Smithers et al, 2016) suggests that impacts from nitrogen oxides (NOx) and nitrogen dioxide (NO2) (both key components of vehicle emission pollution) on vegetation are greatest within the first 50 – 100 m. As a result of such studies, Highways England (2019) states that air quality monitoring for effects on biodiversity is required up to 200 m from source, if traffic will exceed stated volumes. However, the Proposed Development does not exceed the stated traffic volumes. Therefore, the standard 10km ZoI is considered appropriate.
Nationally designated sites	2km	The typical distance at which statutory consultees consider possible effects on nationally designated sites from developments is 2km. There is no hydrological connectivity in this case beyond 2km, and as noted above the Proposed Development does not involve stack emissions. Therefore, 2km is considered appropriate.

Ecological Feature	Adopted ZoI	Rationale
Habitats and plants	250m	Direct impacts on habitats/plants are restricted to the footprint of the Proposed Development. Indirect impacts could occur at a greater distance. A review of the ecological effects of diffuse air pollution arising from road traffic commissioned by Natural England (Smithers et al, 2016) suggests that impacts from nitrogen oxides (NOx) and nitrogen dioxide (NO2) (both key components of vehicle emission pollution) on vegetation are greatest within the first 50 – 100 m. As a result of such studies, Highways England (2019) states that air quality monitoring for effects on biodiversity is required up to 200 m from source, if traffic will exceed stated volumes. The Scottish Environment Protection Agency (SEPA) suggests that impacts on groundwater dependent terrestrial ecosystems (GWDTE) can occur up to 250 m from developments which involve excavations of more than 1 m depth (SEPA, 2017). It is not deemed likely that effects on groundwater from this Proposed Development could exceed this distance, which does not include water abstraction or other means of having very severe effects on groundwater.
Bats	100m	It is generally accepted that disturbance of most roosting bats from typical construction activities is unlikely to occur beyond 50 m from source. For severe activities such as piling/blasting, roosts might be affected at distances of up to 100m or 200m at most. In terms of collision risks during foraging/commuting, and considering the absence of bat species specialising in open ground but presence of species that tend to follow woodland edges, SNH *et al* (2019) indicates that collision risk can be significant where turbines blades are within 50m of woodland/trees.
Otter	200m	Otter can range widely, with territory sizes of up to 21 km for females and 48 km for males (Harris and Yalden, 2008). They can be highly tolerant of noise and other disturbance, especially where accustomed to it, and refuges can exist in cover near humans. For individual otter refuges, 200m is the maximum distance at which disturbance could likely occur, in the case of breeding refuges. For non-breeding refuges 30m is the typical disturbance distance, except where severe activities such as piling/blasting take place for which disturbance could

Ecological Feature	Adopted ZoI	Rationale
		occur across a longer distance. For such severe activities, and considering sound level at source, reduction of sound level over distance, and the shorter distances within which vibration typically reduces to low levels, disturbance is not likely beyond 100m or 200m at most.
Pine marten/Wildcat	200m	Disturbance effects on pine marten and wildcat are likely to extend over similar distances to those stated for otter (see above).
Red squirrel	200m	Significant disturbance effects on red squirrel are unlikely beyond 50m in the case of breeding dreys. In the case of severe activities such as piling/blasting, and similarly to the reasoning given for otter above, disturbance could occur at up to 100m or 200m at most.
Reptiles	200m	The common reptiles present in the area are unlikely to be subject to disturbance at greater distances than those given for the protected mammals above.
Fish/Watercourses	7km	Fish habitat could only be directly affected within the infrastructure footprint. Pollutants during construction or operation could have adverse effects on fish. The downstream extent of the Clachaig Water from near the source to the sea could be affected, which reaches 7km.

2. References

- CIEEM. (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Version 1.1 – Updated September 2019. Chartered Institute of Ecology and Environmental Management, Winchester.
- Harris, S. and Yalden, D.W. (2008). Mammals of the British Isles (4th Edition). The Mammal Society, Southampton.
- Highways England (2019). DMRB Sustainability and Environment Appraisal: LA105 Air Quality. Highways England.
- SEPA (2017). Land Use Planning System SEPA Guidance Note 31. SEPA.
- Smithers R, Harris R and Hitchcock G (2016). The ecological effects of air pollution from road transport: an updated review. Natural England Commissioned Report NECR199. Natural England.
- Scottish Natural Heritage, Natural England, Natural Resources Wales, RenewableUK, Scottish Power Renewables, Ecotricity Ltd, University of Exeter and Bat Conservation Trust (2019). Bats and onshore wind turbines: survey, assessment and mitigation.

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Appendix 10.1: Zone of Influence for Ornithological Features

Appendix 10.1 Zone of Influence for Ornithological Features

1. The Zone of Influence

1.1.1 This Appendix accompanies Chapter 10 of the Environmental Impact Assessment Report (EIAR): Ornithology (Volume 2a). It sets out the 'zone of influence' (ZoI) for ornithological features from the Proposed Development.

1.1.2 The ZoI of the Proposed Development is the area over which ornithological features may be subject to significant effects as a result of its construction, operation, decommissioning and/or associated activities. The ZoI can extend beyond the boundary of the Proposed Development.

1.1.3 The ZoI will vary for different ornithological features depending on their sensitivity to an environmental change. It is therefore appropriate to identify different ZoI for different features. As recommended by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018), professionally accredited or published studies and guidance, where available, were used to help determine the likely ZoI, as well as professional judgement. However, CIEEM (2018) also highlights that establishing the ZoI should be an iterative process and can be informed by further desk study and field survey. Where limited information is available, the precautionary principle was adopted and a ZoI estimated on that basis.

1.1.4 Considering the nature of the Proposed Development, having reviewed published literature, and based on the results of desk study and field survey carried out to establish the baseline conditions, a ZoI was estimated for each relevant ornithological feature.

1.1.5 Relevant ornithological features are those which were considered to be important in the context of this Environmental Impact Assessment (EIA; see Chapter 10 of the EIAR, Volume 2a) and for which significant effects could have occurred as a result of the Proposed Development. Therefore, ZoI are not given for all features, including species, which were identified within or near to the Development Site. ZoI for certain ornithological features were not estimated because they were not considered to be important and/or because the potential for significant effects on them could clearly be discounted out prior to detailed impact assessment.

1.1.6 The ZoI adopted in this EIA are given in Table 1.

Table 1 Zone of Influence of the Proposed Development on Relevant Ornithological Features

Ornithological Feature	Adopted ZoI	Rationale
Internationally designated sites	10km	The core foraging range of Greenland white-fronted goose *Anser albifrons falvirostris* during winter is 5 – 8km (SNH, 2016). Other goose species have larger core foraging ranges, up to 20km for pink-footed goose *Anser brachyrhynchus* and greylag goose *Anser anser*. However, there are no internationally designated sites for these species within this distance of the Development Site. There is no hydrological connection to any internationally designated site beyond 10km, except those in the marine environment. At this distance, there is no possibility of effects from pollution incidents at the Development Site.
Nationally designated sites	2km	The typical distance at which statutory consultees consider possible effects on nationally designated sites from developments is 2km. Both Rhunahaorine Point Site of Special Scientific Interest (SSSI) and Kintyre Goose Lochs SSSI, which are just beyond 2km from the Development Site at their closest points, were included in the assessment given that they are designated for Greenland white-fronted goose which can range more widely than 2km. There are no other nationally designated sites which are connected to the Development Site and which could be significantly affected by the Proposed Development.
Common crossbill *Loxia curvirostra*	150m	Forestry and Land Scotland (FLS) advise a works exclusion zone of between 50 – 150m around the active nest of crossbills for forestry operations (FCS, 2006).
Golden plover *Pluvialis apricaria*	300m	SNH (2016) suggests that the core foraging range of golden plover during the breeding season is 3km. However, this species was not present at the Development Site during the breeding season. No information is available on the foraging range of golden plover during the non-breeding season, but it is likely to be considerably larger than this. However, disturbance to non-breeding golden plover is only likely to occur over a much smaller distance, with Cutts et al (2013) suggesting that disturbance could occur between 200 – 300m.
Golden eagle *Aquila chrysaetos*	6km	SNH (2016) states that the core foraging range for golden eagle during breeding season is 6km. Ruddock and Whitfield (2006) suggest the maximum distance at which disturbance of a golden eagle nest is likely to occur is 2km.
Hen harrier *Circus cyaneus*	2km	The core foraging range of breeding hen harrier is stated in SNH (2016) to be 2km. Disturbance-related impacts are likely to occur at a much smaller distance, with Ruddock and Whitfield (2006) suggesting a maximum distance of 1km.
Kestrel *Falco tinnunculus*	2km	Sale (2016) suggests that kestrel breeding territories are between 1 – 2km^2, with home ranges that may be up to two or three times larger. Winter territories and home ranges are likely to be larger. As for other species, the distance within which disturbance is likely to occur is much smaller than this.
Red-throated diver *Gavia stellata*	8km	Red-throated diver core foraging range during the breeding season is 8km according to SNH (2016). Disturbance-related impacts are likely to occur at a much smaller distance, with Ruddock and Whitfield (2006) suggesting maximum distance of 750m.

Ornithological Feature	Adopted ZoI	Rationale
Black grouse *Tetrao tetrix*	1.5km	SNH (2016) suggests that the core foraging range of male black grouse during the breeding season is 1.5km, and 0.5km for females. Ruddock and Whitfield quote the maximum distance at which disturbance of lekking black grouse may occur as being 750m. The distance at which disturbance of breeding females could occur is stated as being between 10 – 150m.

2. References

- CIEEM. (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Version 1.1 – Updated September 2019. Chartered Institute of Ecology and Environmental Management, Winchester.
- Cutts, N., Hemmingway, K. and Spencer, J. (2013). Waterbird Disturbance Mitigation Toolkit Informing Estuarine Planning and Construction Projects. Institute of Estuarine and Coastal Studies, University of Hull.
- FCS (2006). FCS Guidance Note 32: Forest operations and birds in Scottish Forests – the law and good practice. November 2006.
- Ruddock, M. and Whitfield, D.P. (2006). A Review of Disturbance Distances in Selected Bird Species. A report from Natural Research (Projects) Ltd. to Scottish Natural Heritage.
- Sale, R. (2016). Falcons. HarperCollins Publishers, London.
- SNH. (2016). Assessing Connectivity with Special Protection Areas (SPAs). Version 3 – June 2016.

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Appendix 10.2: Collision Risk Assessment

Clachaig Wind Farm Collision Risk Calculations 2018-2021 plus a comparison with 2014-2016

Alan Fielding

December 2021

Introduction

Collision risk calculations are shown for golden plover, golden eagle, hen harrier, osprey and white-tailed eagle for a revised 12 turbine scheme with 155 m rotor blades (Table 1) (the '**Proposed Development**'). The turbines are in the same approximate locations as used for the 2014-16 calculations, but one vantage point (VP) moved from the south of the development area to the north (see Figure 1 below). In this update, VP observations were undertaken between April 25th 2018 - March 7th 2019, March 11th 2020 - August 8th 2020 and 30th March 2021 to 20th August 2021.

These calculations update previous work undertaken from three VPs between November 21st 2014 and April 6th 2016 for a 14 turbine scheme with 101 m diameter rotor blades (the '**Consented Development**').

There were 16 potential target species: Black grouse; Greylag Goose; Pink-footed Goose; Whooper swan; Curlew; Golden plover; Red throated diver; Golden eagle; Goshawk; Hen harrier; Hobby; Kestrel; Merlin; Osprey; Peregrine falcon and White-tailed eagle. Most target species had no or insufficient recorded activity at rotor swept height (RSH) within the wind farm to justify collision risk calculations.

Turbine characteristics

Table 1. Turbine specifications are for a generic 155 m rotor diameter wind turbine.

Turbine	Value
Rotor diameter (m)	155
Maximum chord width (m)	3.5
Pitch (degrees)	15
Rotation period (s)	5.0
Turbine operation time	85%

Daylight hours

The Development Site is 55.62 degrees N which has 4,484 daylight hours (using the method of Forsythe, W. C. *et al*. 1995. A model comparison for daylength as a function of latitude and day of the year. *Ecological Modelling*, 80: 87-95). Golden eagle, hen harrier and white-tailed eagles were assumed to be present all year. Golden plover were recorded on the site from late October to early April and were assumed to be present between October 1st and April 30th, a total of 2,173 daylight hours. Osprey were assumed to be present between April 1st and August 31st, a total of 2,345 daylight hours.

Vantage Points

Two VPs were used for the calculations. Details are shown in Table 2, including the parameters used to estimate the viewsheds. All viewsheds used a 30 m vertical offset from the ground surface and a 2,000 m horizontal detection threshold. Viewsheds, in relation to the turbine layout, are shown in Figure 1 below.

VPs 1 and 3 were in the same locations throughout. VP 2(a) (2014-16 survey) was at the south of the Development Site, but access restrictions prevented its later use. A different VP 2(b), at the north of

the site, was used for the 2018-2020 surveys, but only a small area (36.0 ha) of its viewshed overlaps the turbine 500 m buffer. VP 2(c) was moved again in March 2021 and the 2021 VP 2(c) viewshed does not overlap with the turbine 500 m buffer. Therefore, these collision calculations make use only of data collected from VPs 1 and 3 between 25/4/18 and 20/8/21. Excluding VP2 data will have no material effect on the collision calculations. The locations of all the VPs are illustrated fully through Figure 10.3 (EIAR Volume 2b).

Turbine 10, which is in the same position in the Proposed Development as it was in the Consented Development (see Figure 1 below), is not covered by any viewshed, including the VP 2(a) viewshed.

Figure 1. Viewsheds and vantage points in relation to the Proposed Development layout. *The Consented Development turbine locations are shown as purple **+**, while the Proposed Development turbines are filled purple circles. The VP 2(a) and its viewshed is shown at the south of the site and VP 2(b) to the north. Contains Ordnance Survey data © Crown copyright and database right 2020.*

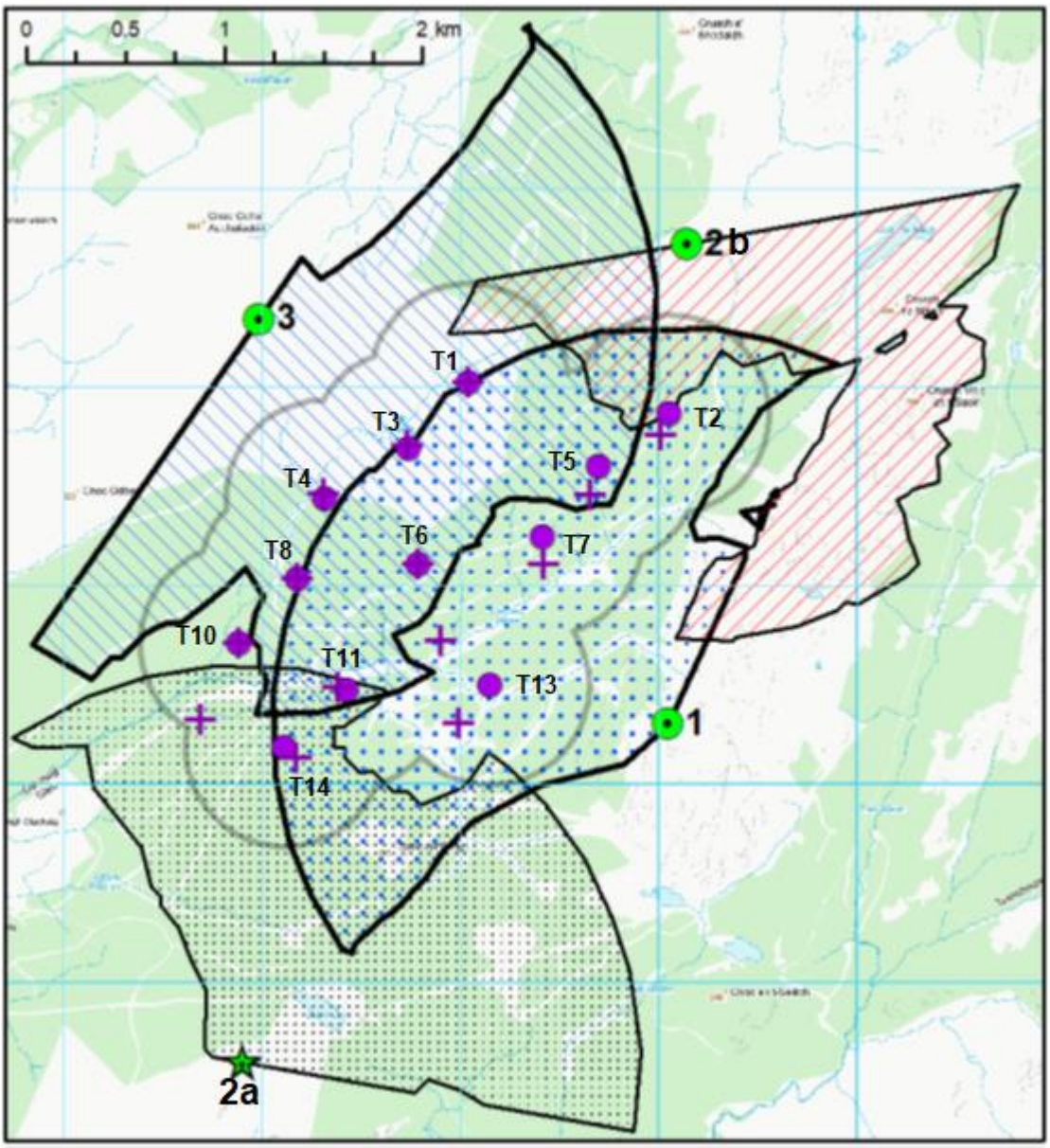

Table 2. Vantage point locations and parameters used to estimate viewsheds*. Vectors 1 & 2 specify horizontal limits of the viewshed.*

VP	X	Y	Vector 1 (°)	Vector 2 (°)
1	173050	641305	225	25
2	*173150*	*643725*	*80*	*260*
3	170985	643350	35	215

Table 3 summarises the surveying activity each month from VPs 1 & 3. Details of individual vantage point surveys are shown in Appendix 1.

Table 3. Summary of surveying hours per vantage point (1 & 3). *As a comparison the surveying hours 2014-16 are also shown.*

	2014-16			**2018-19**			**2020**			**2021**			**2018-21**		
Month	*1*	*3*	*Total*	**1**	**3**	**Total**	**1**	**3**	**Total**	**1**	**3**	**Total**	**1**	**3**	**Total**
Jan	*16*	*23*	*56*	8.8	9.0	17.8							8.8	9.0	17.8
Feb	*22*	*14*	*51*	9.0	9.0	18.0							9.0	9.0	18.0
Mar	*20*	*16*	*54*	10.5	9.0	19.5	6.0	6.0	12.0	6.0	6.0	12.0	22.5	21.0	43.5
Apr	*18*	*18*	*54*	6.0	6.0	12.0	6.0	6.0	12.0	6.0	6.0	12.0	18.0	18.0	36.0
May	*9*	*9*	*27*	6.0	6.0	12.0	6.0	6.0	12.0	6.0	6.0	12.0	18.0	18.0	36.0
Jun	*9*	*9*	*27*	6.0	6.0	12.0	6.0	6.0	12.0	6.0	6.0	12.0	18.0	18.0	36.0
Jul	*9*	*9*	*27*	6.0	6.0	12.0	6.0	6.0	12.0	6.0	6.0	12.0	18.0	18.0	36.0
Aug	*8*	*9*	*26*	9.0	9.0	18.0	6.0	6.0	12.0	6.0	6.0	12.0	21.0	21.0	42.0
Sep	*9*	*9*	*27*	9.0	9.0	18.0							9.0	9.0	18.0
Oct	*9*	*9*	*27*	9.5	9.0	18.5							9.5	9.0	18.5
Nov	*18*	*18*	*52*	9.0	9.0	18.0							9.0	9.0	18.0
Dec	*19*	*21*	*57*	10.0	9.0	19.0							10.0	9.0	19.0
Summer (Apr-Sept)	*62*	*63*	*188*	42.0	42.0	84.0	30.0	30.0	60.0	30.0	30.0	60.0	102.0	102.0	204.0
Winter (Oct-Mar)	*104*	*100*	*297*	56.8	54.0	110.8	6.0	6.0	12.0	6.0	6.0	12.0	68.8	66.0	134.8
Total	***166***	***163***	***485***	98.8	96.0	194.8	36.0	36.0	72.0	36.0	36.0	72.0	170.8	168	338.8

Biometrics for CRA

1. Golden eagle: 81.5 cm long, 212 cm wing width and a flight speed of 15 m/s are from Provan and Whitfield (2006)[1]
2. Golden plover were assumed to have a body length of 28 cm and a wing width of 72 cm[2]. Flight speed was taken to be 13.7 m/s which is the lower (more conservative) of the two species in the same genus listed in Protocol S1 Supplementary list of flight speeds and biometry of bird species from Alerstam *et al* (2007)[3].
3. Hen harrier: 48 cm long and 110 cm wing width and flight speed of 12 m/s are from Provan and Whitfield (2006).
4. Osprey: 57 cm long and 157 cm wing width and flight speed of 14 m/s are from Provan and Whitfield (2006).
5. White-tailed eagle: 80 cm long and 220 cm wing width and flight speed of 12 m/s are from Provan and Whitfield (2006).

Flight height bands

Flights were placed into height bands for each 15 seconds of the flight. Prior to 2020 flights were placed into three height bands: 1 <30 m; 2 30 – 150 m; 3 >150 m. The 2020 surveys used four height bands: 1 <40 m; 2 40 – 100 m; 3 100 – 180 m; 4 >180 m. Although these height bands are not directly comparable, it has no consequence on the calculations.

All flights in bands 2 and 3 are assumed to be at collision height and are included in these CRA calculations. This means that flight activity at RSH is likely to have been overestimated for the 2018-19 surveys because it includes some flights above the turbine tip.

Table 4 is a summary of flight activity at RSH. A flight within its VP viewshed and a 500 m turbine buffer contributes to the collision calculations, but only if part was in height bands 2 or 3. A flight that did not enter the 500 m turbine buffer, or was never at RSH, did not contribute to the collision calculations.

Collision calculations were not carried out for Canada goose, red throated diver and Whooper swan as there was insufficient flight activity particularly when combined with their very large recommended avoidance rates.

[1] Provan, S. & Whitfield, D.P. 2006. Avian Flight Speeds and Biometrics for Use in Collision Risk Modelling. Unpublished Report to Scottish Natural Heritage.
[2] http://blx1.bto.org/birdfacts/results/bob4850.htm
[3] Alerstam, T., Rosén, M., Bäckman, J., Ericson, P. G., & Hellgren, O. (2007). Flight speeds among bird species: allometric and phylogenetic effects. *PLoS Biol*, *5*(8), e197.

Table 4. Summary of flight activity at RSH (seconds) during the three survey periods for VPs 1 & 3. *Collision calculations use the combined 2018-21 data.*

	2018-21		2018-19		2020		2021	
Species	**1**	**3**	**1**	**3**	**1**	**3**	**1**	**3**
Canada Goose	150						150	
Golden eagle	1,854	1,046	1,364	1,046	459		31	
Golden plover		10,272		10,272				
Hen harrier	272	68	92		39		141	68
Osprey	1,333	949		949			1,333	
Red throated diver	21		21					
White-tailed eagle		221						221
Whooper Swan	49		49					

Annual estimated collision risk mortality

Detailed calculations for 2018-21 are shown below, see 'COLLISION RISK CALCULATIONS'. The calculations for the earlier period are in Appendix 2 and have been taken from the 2016 EIA for the Consented Development (Originally, Annexes 1 to 9 of Appendix 10.1; Environmental Statement Volume 3). Table 5 is a summary of both sets of calculations.

Table 5 Summary of the estimated number of collision deaths for the two survey periods.

	2014-16		2018-21	
	per year	**35 years**	**per year**	**35 years**
Golden eagle	0.100	3.50	0.148	5.18
Golden plover	0.070	2.45	0.679	23.77
Hen harrier	0.050	1.75	0.011	0.38
Osprey			0.179	6.26
White-tailed eagle			0.026	0.91

Despite the different layouts for the Consented Development and the Proposed Development, the collision estimates are reasonably similar for golden eagle. An increase of 0.05 deaths for **golden eagle** would not change the conclusions from the 2016 EIA. This is particularly true as recent work has demonstrated the main impact of a wind farm on golden eagles in Scotland is likely to be habitat loss with a very low, but not zero, probability of a collision (Fielding et al 2021a & b [4,5]) so the avoidance rate of 99% is highly precautionary. This, combined with the assumption that all band 3 flights during

[4] Fielding, A.H., Anderson, D., Benn, S., Dennis, R., Geary, M., Weston, E. and Whitfield, D. P. 2021a. Responses of dispersing GPS-tagged Golden Eagles *Aquila chrysaetos* to multiple wind farms across Scotland. Ibis. https://doi.org/10.1111/ibi.12996.

[5] Fielding, A.H., Anderson, D., Benn, S., Dennis, R., Geary, M., Weston, E. and Whitfield, D. P. 2021b. Non-territorial GPS-tagged golden eagles *Aquila chrysaetos* at two Scottish wind farms: macro-avoidance influenced by preferred habitat distribution, wind speed and blade motion status. PLoS ONE 16(8): e0254159. https://doi.org/10.1371/journal.pone.0254159

2018-19 are at RSH, means that the estimated number of collisions from the CRA is too high and the effect of collision mortality on the population would be less than the already low estimates.

The **hen harrier** collision risk is much lower in the 2018-21 calculations, which is explained by the absence of a nearby nest during the 2018-21 surveys which vastly reduced the flights recorded from VPs 1 & 3. In 2014-16 there were 768 s (VP 1) and 770 (VP 2) seconds of flight at RSH compared with only 272 s (VP 1) and 68 s (VP 3) during the 2018-21 surveys.

Proportionately, the largest estimated change in collision mortality was for **golden plover**, which increased almost ten times from 0.07 to 0.68 collision deaths per year. This was mainly the result of a single flock of 24 birds on 22nd January 2019. Despite this large proportional increase, the absolute predicted number killed each year (0.7) would not change the conclusions from the 2016 EIA, in which the potential loss of less than one golden plover per year is small in the context of a large annual wintering population of several thousand (ap Rheinallt et al 2007[6]).

Osprey and white-tailed eagles were not assessed for the 2014-16 surveys. This probably reflects the increases in both species since 2016.

Appendix 3 shows the details of all target species with height band records for every 15 seconds of the record. The table is split into those which potentially contributed to the collision calculations and those which did not. A flight within its VP viewshed and a 500 m turbine buffer could contribute to the collision calculations, but only if part of that flight was at RSH. A flight that did not enter the 500 m turbine buffer or was never at RSH did not contribute to the collision calculations.

[6] ap Rheinallt, T., C. Craik, P. Daw, B. Furness, S. Petty, and D. Wood. 2007. Birds of Argyll. Argyll Bird Club, Lochgilphead.

COLLISION RISK CALCULATIONS

Wind farm area 545.3 ha with 12 Turbines, Vw = 845,215,000 m^3
Daylight hours (estimate) at 55.62N: 4,484 (annual), 2,173 (October 1st - April 30th) and 2,345 (April 1st – 31st August). Wind farm down time 15%

VP survey effort for golden eagle, hen harrier and white-tailed eagle.

VP	Area (ha)	Time (hrs)	HaHr
1	363.6	170.8	62,084.7
3	275.1	168.0	46,216.8
Totals	638.7	338.8	108,301.5

VP survey effort based on weighted effort per unit area per unit time for golden plover.

VP	Area (ha)	Time (hrs)	HaHr
1	363.6	77.8	28,269.9
3	275.1	75.0	20,632.5
Totals	638.7	152.8	48,902.4

VP survey effort based on weighted effort per unit area per unit time for osprey.

VP	Area (ha)	Time (hrs)	HaHr
1	363.6	93.0	33,814.8
3	275.1	93.0	25,584.3
Totals	638.7	186.0	59,399.1

SPECIES-SPECIFIC CALCULATIONS

GOLDEN EAGLE

Flying time (s)	Flying time hahr	Weighted flying time hahr	
Risk height	Risk height	Weighting	Risk height
1,854	0.0000082951	0.573257988	0.000004755
1,046	0.0000062868	0.426742012	0.000002683
2,900	0.0000072910	1.000000000	0.000007438

Mean activity at risk height (hr^{-1}) in wind farm 0.00406 (0. 406%)
Vr = 978,179 m^3, Vr/Vw = 0.0011573, Vw Occupancy = 65,473.4 s, Vr Occupancy = 75.8 s

Transit time = 0.288 s at 15.0 m/s, estimated number of transits = 263.1
Collision probability from SNH sheet 0.066

Annual collisions with no avoidance = 17.4, annual collisions with 99% avoidance = 0.174,
Annual collisions with 99% avoidance & downtime = 0.148
35 year mortality = 5.2 or one death every 6.8 years.

HEN HARRIER

Flying time (s)	Flying time hahr	Weighted flying time hahr	
Risk height	Risk height	Weighting	Risk height
227	0.0000010176	0.573257988	0.000000583
68	0.0000004087	0.426742012	0.000000174
295	0.0000007131	1.000000000	0.000000758

Mean activity at risk height (hr^{-1}) in wind farm 0.00041 (0. 041%)

Vr = 901,193 m^3, Vr/Vw = 0.001066, Vw Occupancy = 2,735.4 s, Vr Occupancy = 2.9 s

Transit time = 0.3317 s at 12.0 m/s, estimated number of transits = 21.4
Collision probability from SNH sheet 0.057

Annual collisions with no avoidance = 1.2, annual collisions with 99% avoidance = 0.012,
Annual collisions with 99% avoidance & downtime = 0.010
35 year mortality = 0.35 or one death every 96.3 years.

WHITE TAILED EAGLE

Flying time (s)	Flying time hahr	Weighted flying time hahr	
Risk height	Risk height	Weighting	Risk height
0	0.0000000000	0.573257988	0.000000000
221	0.0000013283	0.426742012	0.000000567
221	0.0000006641	1.000000000	0.000000567

Mean activity at risk height (hr^{-1}) in wind farm 0.00031 (0. 031%)

Vr = 973,650 m^3, Vr/Vw = 0.0011520, Vw Occupancy = 4,989.5 s, Vr Occupancy = 5.7 s

Transit time = 0.3583 s at 12.0 m/s, estimated number of transits = 16.0
Collision probability from SNH sheet 0.077

Annual collisions with no avoidance = 1.2, annual collisions with 95% avoidance = 0.062,
Annual collisions with 95% avoidance & downtime = 0.052
35 year mortality = 1.8 or one death every 19.1 years.

GOLDEN PLOVER

Flying time (s)	Flying time hahr	Weighted flying time hahr	
Risk height	Risk height	Weighting	Risk height
0	0.0000000000	0.578088192	0.000000000
10,270	0.0001382688	0.421911808	0.000058337
10,270	0.0000691344	1.000000000	0.000058337

Mean activity at risk height (hr^{-1}) in wind farm 0.03181 (3.181%)
Vr = 855,906 m^3, Vr/Vw = 0.0010126, Vw Occupancy = 247,250.1 s, Vr Occupancy =250.4 s

Transit time = 0.2759 s at 13.7 m/s, estimated number of transits = 907.5
Collision probability from SNH sheet 0.044

Annual collisions with no avoidance = 39.9, annual collisions with 98% avoidance = 0.799

Annual collisions with 98% avoidance & downtime = 0.679
35 year mortality = 23.8 or one death every 1.5 years.

OSPREY

Flying time (s)	Flying time hahr	Weighted flying time hahr	
Risk height	Risk height	Weighting	Risk height
1,333	0.0000109502	0.569281353	0.000006234
949	0.0000103036	0.430718647	0.000004438
2,282	0.0000106269	1.000000000	0.000010672

Mean activity at risk height (hr^{-1}) in wind farm 0.00582 (0.5819%)
Vr = 921,571 m^3, Vr/Vw = 0.0010903, Vw Occupancy = 49,126.3 s, Vr Occupancy =53.6 s

Transit time = 0.2907 s at 14 m/s, estimated number of transits = 184.3
Collision probability from SNH sheet 0.057

Annual collisions with no avoidance = 10.5, annual collisions with 98% avoidance = 0.210
Annual collisions with 98% avoidance & downtime = 0.179
35 year mortality = 6.3 or one death every 5.6 years.

Golden Plover Collision Risk Probability

K: [1D or [3D] (0 or 1)	1	
Number of Rotor Blades	3	
Max Chord Width	3.5	m
Pitch (degrees)	15	
Bird Length	0.28	m
Wingspan	0.72	m
F: Flapping (0) or gliding (+1)	0	
Bird speed	13.7	m/sec
Rotor Diameter	155	m
Rotation Period	5.00	sec
Bird aspect ratio:	0.39	

Calculation of alpha and p(collision) as a function of radius

			Upwind:			Downwind:		
r/R	c/C	⍰	collide		contribution	collide		contribution
radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
0.025	0.575	5.63	15.51	0.68	0.00085	14.47	0.63	0.00079
0.075	0.575	1.88	5.52	0.24	0.00181	4.48	0.20	0.00147
0.125	0.702	1.13	4.11	0.18	0.00225	2.84	0.12	0.00156
0.175	0.860	0.80	3.70	0.16	0.00283	2.14	0.09	0.00164
0.225	0.994	0.63	3.45	0.15	0.00340	1.65	0.07	0.00163
0.275	0.947	0.51	2.86	0.13	0.00345	1.15	0.05	0.00138
0.325	0.899	0.43	2.44	0.11	0.00348	0.81	0.04	0.00116
0.375	0.851	0.38	2.13	0.09	0.00350	0.59	0.03	0.00097
0.425	0.804	0.33	1.91	0.08	0.00355	0.45	0.02	0.00084
0.475	0.756	0.30	1.72	0.08	0.00358	0.35	0.02	0.00073
0.525	0.708	0.27	1.56	0.07	0.00359	0.28	0.01	0.00064
0.575	0.660	0.24	1.42	0.06	0.00359	0.33	0.01	0.00084
0.625	0.613	0.23	1.30	0.06	0.00356	0.37	0.02	0.00101
0.675	0.565	0.21	1.19	0.05	0.00352	0.39	0.02	0.00116
0.725	0.517	0.19	1.09	0.05	0.00345	0.41	0.02	0.00130
0.775	0.470	0.18	0.99	0.04	0.00337	0.42	0.02	0.00142
0.825	0.422	0.17	0.91	0.04	0.00327	0.42	0.02	0.00151
0.875	0.374	0.16	0.82	0.04	0.00315	0.42	0.02	0.00159
0.925	0.327	0.15	0.74	0.03	0.00301	0.41	0.02	0.00165
0.975	0.279	0.14	0.67	0.03	0.00286	0.40	0.02	0.00169

Overall p(collision) =	**Upwind**	**6.2%**	**Downwind**	**2.5%**
			Average	**4.4%**

Golden Eagle Collision Risk Probability

K: [1D or [3D] (0 or 1)	1	
Number of Rotor Blades	3	
Max Chord Width	3.5	m
Pitch (degrees)	15	
Bird Length	0.815	m
Wingspan	2.12	m
F: Flapping (0) or gliding (+1)	0	
Bird speed	15	m/sec
Rotor Diameter	155	m
Rotation Period	5.00	sec
Bird aspect ratio:	0.38	

Calculation of alpha and p(collision) as a function of radius

			Upwind:			Downwind:		
r/R	c/C	⍰	collide		contribution	collide		contribution
radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
0.025	0.575	6.16	25.56	1.00	0.00125	24.52	0.98	0.00123
0.075	0.575	2.05	8.87	0.35	0.00266	7.82	0.31	0.00235
0.125	0.702	1.23	6.17	0.25	0.00308	4.90	0.20	0.00245
0.175	0.860	0.88	5.20	0.21	0.00364	3.65	0.15	0.00255
0.225	0.994	0.68	4.65	0.19	0.00419	2.85	0.11	0.00257
0.275	0.947	0.56	3.84	0.15	0.00422	2.12	0.08	0.00233
0.325	0.899	0.47	3.26	0.13	0.00424	1.63	0.07	0.00212
0.375	0.851	0.41	2.82	0.11	0.00424	1.28	0.05	0.00192
0.425	0.804	0.36	2.53	0.10	0.00431	1.08	0.04	0.00183
0.475	0.756	0.32	2.33	0.09	0.00443	0.96	0.04	0.00183
0.525	0.708	0.29	2.16	0.09	0.00454	0.88	0.04	0.00185
0.575	0.660	0.27	2.02	0.08	0.00464	0.82	0.03	0.00189
0.625	0.613	0.25	1.89	0.08	0.00471	0.86	0.03	0.00216
0.675	0.565	0.23	1.77	0.07	0.00477	0.90	0.04	0.00242
0.725	0.517	0.21	1.66	0.07	0.00481	0.92	0.04	0.00266
0.775	0.470	0.20	1.56	0.06	0.00484	0.93	0.04	0.00288
0.825	0.422	0.19	1.47	0.06	0.00485	0.94	0.04	0.00309
0.875	0.374	0.18	1.38	0.06	0.00484	0.94	0.04	0.00328
0.925	0.327	0.17	1.30	0.05	0.00481	0.93	0.04	0.00345
0.975	0.279	0.16	1.22	0.05	0.00476	0.92	0.04	0.00360

Overall p(collision) = Upwind 8.4% Downwind 4.8%

Average 6.6%

Hen Harrier Collision Risk Probability

K: [1D or [3D] (0 or 1)	1	
Number of Rotor Blades	3	
Max Chord Width	3.5	m
Pitch (degrees)	15	
Bird Length	0.48	m
Wingspan	1.1	m
F: Flapping (0) or gliding (+1)	0	
Bird speed	12	m/sec
Rotor Diameter	155	m
Rotation Period	5.00	sec
Bird aspect ratio:	0.44	

Calculation of alpha and p(collision) as a function of radius

			Upwind:			Downwind:		
r/R radius	c/C chord	⍰ alpha	collide length	p(collision)	contribution from radius r	collide length	p(collision)	contribution from radius r
0.025	0.575	4.93	15.52	0.78	0.00097	14.48	0.72	0.00091
0.075	0.575	1.64	5.52	0.28	0.00207	4.48	0.22	0.00168
0.125	0.702	0.99	4.06	0.20	0.00254	2.79	0.14	0.00174
0.175	0.860	0.70	3.60	0.18	0.00315	2.04	0.10	0.00179
0.225	0.994	0.55	3.34	0.17	0.00376	1.54	0.08	0.00174
0.275	0.947	0.45	2.78	0.14	0.00383	1.07	0.05	0.00147
0.325	0.899	0.38	2.45	0.12	0.00398	0.82	0.04	0.00133
0.375	0.851	0.33	2.20	0.11	0.00412	0.65	0.03	0.00123
0.425	0.804	0.29	2.00	0.10	0.00424	0.54	0.03	0.00115
0.475	0.756	0.26	1.83	0.09	0.00434	0.50	0.03	0.00119
0.525	0.708	0.23	1.68	0.08	0.00442	0.56	0.03	0.00147
0.575	0.660	0.21	1.56	0.08	0.00448	0.60	0.03	0.00172
0.625	0.613	0.20	1.44	0.07	0.00451	0.63	0.03	0.00196
0.675	0.565	0.18	1.34	0.07	0.00452	0.64	0.03	0.00217
0.725	0.517	0.17	1.25	0.06	0.00452	0.65	0.03	0.00236
0.775	0.470	0.16	1.16	0.06	0.00449	0.65	0.03	0.00253
0.825	0.422	0.15	1.08	0.05	0.00444	0.65	0.03	0.00268
0.875	0.374	0.14	1.00	0.05	0.00436	0.64	0.03	0.00280
0.925	0.327	0.13	0.92	0.05	0.00427	0.63	0.03	0.00291
0.975	0.279	0.13	0.85	0.04	0.00415	0.61	0.03	0.00299

Overall p(collision) = Upwind 7.7% Downwind 3.8%

Average 5.7%

Osprey

K: [1D or [3D] (0 or 1)	1		**Calculation of alpha and p(collision) as a function of radius**								
NoBlades	3					Upwind:			Downwind:		
MaxChord	3.5	m	r/R	c/C	a	collide		contribution	collide		contribution
Pitch (degrees)	15		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.57	m	0.025	0.575	5.75	20.78	0.89	0.00111	19.74	0.85	0.00106
Wingspan	1.58	m	0.075	0.575	1.92	7.28	0.31	0.00234	6.23	0.27	0.00200
F: Flapping (0) or gliding (+1)	0		0.125	0.702	1.15	5.18	0.22	0.00277	3.91	0.17	0.00209
			0.175	0.860	0.82	4.47	0.19	0.00335	2.91	0.12	0.00218
Bird speed	14	m/sec	0.225	0.994	0.64	4.06	0.17	0.00391	2.26	0.10	0.00218
RotorDiam	155	m	0.275	0.947	0.52	3.36	0.14	0.00396	1.64	0.07	0.00193
RotationPeriod	5.00	sec	0.325	0.899	0.44	2.86	0.12	0.00398	1.23	0.05	0.00171
			0.375	0.851	0.38	2.48	0.11	0.00399	0.94	0.04	0.00151
			0.425	0.804	0.34	2.22	0.10	0.00404	0.76	0.03	0.00139
			0.475	0.756	0.30	2.03	0.09	0.00413	0.66	0.03	0.00134
Bird aspect ratio: b	0.36		0.525	0.708	0.27	1.87	0.08	0.00420	0.58	0.03	0.00131
			0.575	0.660	0.25	1.73	0.07	0.00425	0.61	0.03	0.00150
			0.625	0.613	0.23	1.60	0.07	0.00429	0.65	0.03	0.00174
			0.675	0.565	0.21	1.49	0.06	0.00431	0.68	0.03	0.00195
			0.725	0.517	0.20	1.39	0.06	0.00430	0.69	0.03	0.00215
			0.775	0.470	0.19	1.29	0.06	0.00428	0.70	0.03	0.00233
			0.825	0.422	0.17	1.20	0.05	0.00425	0.70	0.03	0.00249
			0.875	0.374	0.16	1.12	0.05	0.00419	0.70	0.03	0.00263
			0.925	0.327	0.16	1.04	0.04	0.00411	0.69	0.03	0.00275
			0.975	0.279	0.15	0.96	0.04	0.00402	0.68	0.03	0.00286

Overall p(collision) =	**Upwind**	**7.6%**		**Downwind**	**3.9%**
		Average	**5.7%**		

White-tailed eagle

K: [1D or [3D] (0 or 1)	1		**Calculation of alpha and p(collision) as a function of radius**								
NoBlades	3						Upwind:			Downwind:	
MaxChord	3.5	m	r/R	c/C	a	collide		contribution	collide		contribution
Pitch (degrees)	15		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.8	m	0.025	0.575	4.93	20.94	1.00	0.00125	19.90	1.00	0.00124
Wingspan	2.2	m	0.075	0.575	1.64	7.33	0.37	0.00275	6.29	0.31	0.00236
F: Flapping (0) or gliding (+1)	0		0.125	0.702	0.99	5.14	0.26	0.00321	3.87	0.19	0.00242
			0.175	0.860	0.70	4.38	0.22	0.00383	2.82	0.14	0.00247
Bird speed	12	m/sec	0.225	0.994	0.55	3.95	0.20	0.00444	2.14	0.11	0.00241
RotorDiam	155	m	0.275	0.947	0.45	3.28	0.16	0.00451	1.56	0.08	0.00215
RotationPeriod	5.00	sec	0.325	0.899	0.38	2.80	0.14	0.00455	1.17	0.06	0.00190
			0.375	0.851	0.33	2.52	0.13	0.00472	0.97	0.05	0.00183
			0.425	0.804	0.29	2.32	0.12	0.00492	0.86	0.04	0.00183
			0.475	0.756	0.26	2.15	0.11	0.00510	0.82	0.04	0.00195
Bird aspect ratio: b	0.36		0.525	0.708	0.23	2.00	0.10	0.00526	0.88	0.04	0.00231
			0.575	0.660	0.21	1.88	0.09	0.00540	0.92	0.05	0.00264
			0.625	0.613	0.20	1.76	0.09	0.00551	0.95	0.05	0.00296
			0.675	0.565	0.18	1.66	0.08	0.00560	0.96	0.05	0.00325
			0.725	0.517	0.17	1.57	0.08	0.00568	0.97	0.05	0.00352
			0.775	0.470	0.16	1.48	0.07	0.00573	0.97	0.05	0.00377
			0.825	0.422	0.15	1.40	0.07	0.00576	0.97	0.05	0.00400
			0.875	0.374	0.14	1.32	0.07	0.00576	0.96	0.05	0.00420
			0.925	0.327	0.13	1.24	0.06	0.00575	0.95	0.05	0.00439
			0.975	0.279	0.13	1.17	0.06	0.00571	0.93	0.05	0.00455

Overall p(collision) = Upwind 9.5% Downwind 5.6%

Average 7.6%

Appendix 1. Details of vantage point watches

2018-21 data are shown first followed by the earlier 2014-16 data. Columns 1, 2 & 3 refer to the survey hour within a 3 hour survey. Note that VP 2 is not comparable across the two survey periods

Wind speed index: 0 – calm; 1 light air; 2 – light breeze; 3 – gentle breeze; 4 – moderate breeze; 5 – fresh breeze; 6 – strong breeze. Rain index: 0 - none; 1 - drizzle; 2 – light shower; 3 – heavy shower; 4 – heavy rain. Cloud height: 0 <150 m; 1 – 150-500m; 2 > 500m, Visibility: 1 – moderate; 2 – good.

				Wind speed			Direction			Rain			Cloud cover			Cloud height			Visibility		
Date	VP	Start	End	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
25/04/2018	3	06:25	09:25	3	3	3	SW	SW	SW	0	0	0	7	6	5	2	2	2	2	2	2
25/04/2018	3	09:55	12:55	3	3	4	SW	SW	SW	0	0	0	5	7	4	2	2	2	2	2	2
25/04/2018	1	12:30	15:30	3	3	3	SW	SW	SW	2	2	0	7	5	5	2	2	2	2	2	2
25/04/2018	1	16:00	19:00	3	4	4	SW	W	W	0	0	0	7	7	7	2	2	2	2	2	2
30/05/2018	1	05:30	08:30	4	4	3	E	E	E	0	0	0	1	1	1	2	2	2	2	2	2
30/05/2018	1	09:00	12:00	3	3	3	E	E	E	0	0	0	1	1	1	2	2	2	2	2	2
30/05/2018	3	12:20	15:20	3	3	3	ENE	ENE	ENE	0	0	0	1	1	1	2	2	2	2	2	2
30/05/2018	3	15:50	18:50	3	3	3	ENE	NE	WNW	0	0	0	1	2	4	2	2	2	2	2	2
26/06/2018	3	06:35	09:35	1	1	2	SE	SE	SE	0	0	0	7	6	6	2	2	2	2	2	2
26/06/2018	3	10:05	13:05	2	2	2	SE	SE	SE	0	0	0	7	7	7	2	2	2	2	2	2
26/06/2018	1	13:15	16:15	2	2	2	SE	SE	SE	0	0	0	7	5	7	2	2	2	2	2	2
26/06/2018	1	16:45	19:45	2	2	2	SE	SE	SE	0	0	0	7	5	5	2	2	2	2	2	2
25/07/2018	3	06:05	09:05	2	2	2	SE	SE	SE	0	0	0	6	4	4	2	2	2	2	2	2
25/07/2018	3	09:35	12:35	2	3	3	SE	SE	SE	0	0	0	3	2	2	2	2	2	2	2	2
25/07/2018	1	12:15	15:15	4	3	3	S	S	SSE	0	0	0	5	3	3	2	2	2	2	2	2
25/07/2018	1	15:45	18:45	3	3	3	SSE	SSE	SSE	0	0	0	3	1	1	2	2	2	2	2	2
24/08/2018	2	06:05	09:05	2	3	3	W	W	W	2	2	2	8	7	7	2	2	2	2	2	2
24/08/2018	3	06:40	09:40	2	3	3	W	W	W	0	2	0	3	4	3	1	1	2	2	2	2
24/08/2018	2	09:35	11:05	3	3		W	W		2	2		7	7		2	2		2	2	
24/08/2018	3	10:10	13:10	3	3	3	W	W	W	0	0	0	5	5	5	2	2	2	2	2	2
24/08/2018	1	11:55	14:55	4	4	4	W	W	W	2	0	2	7	5	7	2	2	2	2	2	2
24/08/2018	2	14:05	17:05	3	3	3	W	W	W	2	2	2	6	4	5	2	2	2	2	2	2
24/08/2018	1	15:25	16:55	4	4		W	W		2	0	0	7	7		2	2		2	2	
25/08/2018	3	06:50	09:50	3	3	3	W	W	W	0	0	0	2	1	2	2	2	2	2	2	2
25/08/2018	1	09:45	12:45	3	4	3	W	SW	W	0	0	0	7	5	5	2	2	2	2	2	2
25/08/2018	2	10:35	12:05	3	3		W	W		0	0		3	3		2	2		2	2	
25/08/2018	1	13:15	14:45	3	3		W	W		0	0		5	5		2	2		2	2	
18/09/2018	2	06:20	09:20	3	3	4	W	W	W	2	0	2	8	8	8	2	2	1	2	2	1
18/09/2018	3	08:20	11:20	3	3	3	SE	SE	S	0	2	2	8	8	8	1	1	1	2	2	1

				Wind speed			Direction			Rain			Cloud cover			Cloud height			Visibility		
Date	VP	Start	End	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
18/09/2018	3	11:50	14:50	3	4	4	S	S	SW	2	2	0	8	8	8	1	1	1	1	1	1
18/09/2018	1	13:30	16:30	4	4	4	SSW	SSW	SSW	0	0	0	7	5	7	2	2	2	2	2	2
18/09/2018	2	15:50	18:50	3	3	3	SW	SW	SW	0	0	0	4	5	3	2	2	2	2	2	2
18/09/2018	1	17:00	20:00	4	5	5	SSW	SSW	SSW	2	0	0	7	7	7	2	2	2	2	2	2
19/09/2018	1	06:25	09:25	5	6	6	SSW	SSW	S	3	3	3	8	8	8	2	2	2	2	2	2
19/09/2018	2	08:05	09:35	5	5		S	S		3	3		8	8		2	2		2	2	
19/09/2018	3	10:10	13:10	5	6	6	S	S	S	2	2	2	8	8	8	1	1	1	2	2	2
19/09/2018	2	11:50	13:20	6	6		S	S		0	2		8	8		2	2		2	2	
23/10/2018	2	07:15	10:15	5	4	4	W	W	W	2	2	2	8	8	8	1	1	1	1	1	1
23/10/2018	3	08:15	11:15	4	4	4	W	W	W	1	2	2	8	8	8	1	1	1	1	1	1
23/10/2018	3	11:45	14:45	4	4	4	W	W	W	1	2	2	8	8	8	1	1	1	1	1	1
23/10/2018	1	12:20	15:50	4	4	4	W	W	W	2	2	2	8	8	8	1	1	1	1	1	1
23/10/2018	2	15:05	18:05	5	5	5	NW	NW	NW	2	1	0	8	8	8	1	1	1	1	1	1
23/10/2018	1	15:50	18:50	4	4	4	W	W	W	2	2	2	8	8	8	1	1	1	1	1	1
24/10/2018	1	07:25	10:25	4	3	3	W	W	W	2	2	2	8	8	8	1	1	1	1	1	1
24/10/2018	2	08:00	09:30	3	4		NW	N		0	1		8	8		1	1		1	1	
24/10/2018	3	10:05	13:05	4	3	3	W	W	W	1	0	0	8	8	8	1	1	1	2	2	2
24/10/2018	2	11:10	12:40	4	3		W	W		2	0	0	8	8		1	1		1	1	
20/11/2018	2	07:00	10:00	5	4	4	ENE	ENE	ENE	0	0	0	5	7	8	2	2	2	1	2	2
20/11/2018	3	07:00	10:00	5	4	4	ENE	ENE	ENE	0	0	0	5	7	8	2	2	2	2	2	2
20/11/2018	3	10:30	13:30	4	4	4	E	E	E	2	2	2	5	4	4	2	2	2	2	2	2
20/11/2018	1	10:40	13:40	4	5	5	ENE	ENE	ENE	0	2	2	7	7	7	2	2	2	2	2	2
20/11/2018	2	14:00	17:00	5	5	5	ENE	ENE	ENE	3	0	2	4	6	7	2	2	2	2	2	2
20/11/2018	1	14:10	17:10	5	4	4	ENE	ENE	ENE	2	0	2	7	7	7	2	2	2	2	2	2
21/11/2018	1	07:15	10:15	4	3	3	E	E	E	2	0	0	8	7	7	2	2	2	1	2	2
21/11/2018	2	07:50	09:35	4	4		E	E		0	0		6	4		2	2		2	2	
21/11/2018	3	10:05	13:05	4	4	4	E	E	E	0	0	2	7	7	7	2	2	2	2	2	2
21/11/2018	2	11:05	15:50	4	4		E	E		0	0		7	7		2	2		2	2	
11/12/2018	2	07:40	10:40	4	4	5	SE	SE	SE	2	2	2	8	8	8	1	1	1	1	1	1
11/12/2018	3	08:05	11:05	4	4	5	SE	SE	SE	2	2	2	8	8	8	1	1	1	1	1	1
11/12/2018	1	11:20	14:20	5	5	5	SE	SE	SE	2	2	2	8	8	8	1	1	1	1	1	1
11/12/2018	3	11:35	14:35	5	5	6	SE	SE	SE	1	1	1	8	8	8	1	1	1	1	1	1
11/12/2018	1	14:50	16:50	5	5		SE	SE		2	2		8	8		1	1		1	1	
11/12/2018	2	15:05	17:05	5	6		SE	SE		1	1		8	8		1	1		1	1	
12/12/2018	1	08:00	11:30	5	5		SE	SE		2	2		8	8		1	1		1	1	
12/12/2018	2	08:05	11:05	4	4		SE	SE		0	1		8	8		1	0		1	1	
12/12/2018	1	11:00	12:30	5	5		SE	SE		2	2		8	8		1	1		1	1	
12/12/2018	3	11:10	14:10	5	5	5	SE	SE	SE	1	1	1	8	8	8	1	1	1	1	1	1

				Wind speed			Direction			Rain			Cloud cover			Cloud height			Visibility		
Date	VP	Start	End	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
12/12/2018	2	13:15	14:45	5	6		SE	SE		2	2		8	8		1	1		1	1	
22/01/2019	2	07:35	10:35	2	3	3	NW	NW	NW	2	2	0	8	7	8	2	2	2	2	2	2
22/01/2019	3	07:50	10:50	2	2	1	W	W	W	3	2	0	8	8	5	2	2	2	2	2	2
22/01/2019	1	11:15	14:15	2	2	3	NW	W	W	2	2	2	7	7	8	2	2	2	2	2	2
22/01/2019	3	11:20	14:20	1	1	2	W	W	W	2	2	0	4	6	3	2	2	2	2	2	2
22/01/2019	1	14:45	17:30	2	2	2	W	W	W	2	0	0	7	7	7	2	2	2	2	2	2
22/01/2019	2	14:45	17:30	2	2	2	W	W	W	0	0	2	6	5	8	2	2	2	2	2	2
23/01/2019	1	07:50	10:50	2	2	2	W	W	W	0	0	0	5	5	7	2	2	2	2	2	2
23/01/2019	2	08:30	11:30	1	1	0	W	W		0	0	0	5	6	4	2	2	2	2	2	2
23/01/2019	2	12:00	14:00	1	2		W	W		0	0		5	6		2	2		2	2	
23/01/2019	3	12:05	15:05	3	3	3	W	W	W	0	0	0	5	5	7	2	2	2	2	2	2
05/02/2019	2	07:10	10:10	5	5	5	SE	SE	SE	0	2	0	7	7	8	2	2	2	2	2	2
05/02/2019	3	07:50	10:50	4	5	5	SW	SW	SW	0	0	0	8	8	8	2	2	2	2	2	2
05/02/2019	1	11:00	14:00	5	5	5	SE	SE	SE	0	2	3	7	8	8	2	2	1	2	2	2
05/02/2019	3	11:10	14:10	6	5	5	SW	S	S	0	0	0	6	7	7	2	2	2	2	2	2
05/02/2019	2	14:30	17:30	6	7	6	S	SSE	SE	3	2	2	8	8	8	1	1	1	2	2	1
05/02/2019	1	14:30	17:30	5	4	4	SE	SE	SE	2	2	2	8	8	8	2	1	1	1	1	1
06/02/2019	1	07:20	10:20	3	4	4	S	S	S	0	0	0	7	7	7	2	2	2	1	2	2
06/02/2019	2	08:00	09:30	3	2		SW	SW		0	0	0	6	4		2	2		2	2	
06/02/2019	3	10:05	13:05	3	3	3	SW	SW	SW	0	0	0	7	7	4	2	2	2	2	2	2
06/02/2019	2	11:05	12:35	3	3		S	S		0	0		7	7		2	2		2	2	
06/03/2019	2	08:25	11:25	6	5	5	E	E	NE	3	2	2	8	8	8	1	1	1	1	2	2
06/03/2019	3	08:30	11:30	5	5	5	E	E	SE	2	2	2	8	8	8	1	1	1	2	2	2
06/03/2019	3	12:00	15:00	4	4	4	SE	S	SSW	2	2	2	8	8	8	1	1	1	1	2	2
06/03/2019	1	12:10	15:10	4	3	3	NE	NE	E	2	2	2	8	8	7	1	2	2	1	2	2
06/03/2019	2	15:30	18:30	2	3	2	S	SE	SE	2	0	0	8	7	7	1	1	1	1	2	2
06/03/2019	1	15:40	18:40	3	3	3	SE	SE	SE	0	0	0	7	7	7	2	2	2	2	2	2
07/03/2019	2	08:00	09:30	3	3		NNW	NNW		2	0		8	8		2	2		2	2	
07/03/2019	1	08:25	11:25	4	3	3	NW	NW	NW	2	0	0	8	7	7	2	2	2	2	2	2
07/03/2019	3	10:20	13:20	4	4	4	NNW	NNW	NNW	0	0	0	7	7	6	2	2	2	2	2	2
07/03/2019	1	12:10	13:40	3	3		NW	NW		0	0		7	7		2	2		2	2	
2020 start																					
11/03/2020	2	12:40	15:40	4	4	4	W	W	W	2	0	2	8	8	8	2	2	2	2	2	2
11/03/2020	2	16:10	19:10	5	5	4	SW	SW	SW	2	2	0	8	8	8	2	2	2	2	2	2
12/03/2020	3	08:35	11:35	6	6	6	SW	SW	SW	2	2	2	8	8	8	2	2	2	2	2	2
12/03/2020	3	12:05	15:05	7	7	7	SW	SW	SW	2	2	2	8	8	8	2	2	2	2	2	2
13/03/2020	1	08:30	11:30	4	4	5	E	E	E	0	0	0	1	1	1	2	2	2	2	2	2

				Wind speed			Direction			Rain			Cloud cover			Cloud height			Visibility		
Date	VP	Start	End	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
13/03/2020	1	12:00	15:00	4	5	4	E	E	E	0	0	0	1	3	3	2	2	2	2	2	2
27/04/2020	1	12:05	15:05	3	3	3	NW	NW	NW	0	0	0	3	3	3	2	2	2	2	2	2
27/04/2020	1	15:35	18:35	3	3	3	NW	NW	NW	0	0	0	3	1	1	2	2	2	2	2	2
28/04/2020	2	05:50	08:50	3	3	3	E	E	SE	0	0	0	3	3	5	2	2	2	2	2	2
28/04/2020	2	09:30	12:30	3	3	3	SE	SE	SE	0	0	0	5	5	7	2	2	2	2	2	2
29/04/2020	3	05:45	08:45	4	4	4	E	E	E	0	0	0	7	7	7	2	2	2	2	2	2
29/04/2020	3	09:15	12:15	4	3	3	E	E	E	0	0	2	7	7	7	2	2	2	2	2	2
29/05/2020	2	14:00	17:00	4	4	4	SE	SE	SE	0	0	0	1	3	5	2	2	2	2	2	2
29/05/2020	2	17:30	20:30	4	4	4	SE	SE	SE	0	0	0	3	3	3	2	2	2	2	2	2
30/05/2020	1	06:05	09:05	4	4	3	SE	SE	SE	0	0	0	1	1	3	2	2	2	2	2	2
30/05/2020	1	09:35	12:35	3	3	3	SE	SE	SE	0	0	0	3	3	3	2	2	2	2	2	2
31/05/2020	3	05:55	08:55	3	3	2	SE	SE	SE	0	0	0	1	1	1	2	2	2	2	2	2
31/05/2020	3	09:25	12:25	2	2	2	SE	SE	SE	0	0	0	1	1	1	2	2	2	2	2	2
11/06/2020	2	14:40	17:40	4	3	3	NE	E	E	0	0	0	5	5	5	2	2	2	2	2	2
11/06/2020	2	18:10	21:10	4	4	3	NE	NE	NE	0	0	0	5	5	7	2	2	2	2	2	2
12/06/2020	1	05:45	08:45	5	5	4	NE	NE	E	0	0	0	7	7	7	2	2	2	2	2	2
12/06/2020	1	09:15	12:15	4	4	4	E	E	E	0	0	0	7	7	7	2	2	2	2	2	2
13/06/2020	3	05:10	08:10	4	4	4	NE	NE	NE	0	0	2	7	7	7	2	2	2	2	2	2
13/06/2020	3	08:40	11:40	3	3	3	NE	NE	NE	2	2	2	7	7	7	2	2	2	2	2	2
09/07/2020	2	05:15	08:15	3	3	3	W	W	W	0	0	0	5	5	5	2	2	2	2	2	2
09/07/2020	2	08:45	11:45	3	3	3	W	W	W	0	0	0	7	7	7	2	2	2	2	2	2
10/07/2020	1	14:10	17:10	3	3	3	NW	NW	NW	0	0	2	7	5	7	2	2	2	2	2	2
10/07/2020	1	17:40	20:40	3	3	3	W	W	W	0	0	0	7	7	7	2	2	2	2	2	2
11/07/2020	3	06:05	09:05	3	3	3	W	W	NW	0	0	2	7	7	8	2	2	2	2	2	2
11/07/2020	3	09:35	12:35	3	3	3	NW	W	W	2	2	2	8	8	7	2	2	2	2	2	2
04/08/2020	3	14:50	17:50	4	4	4	W	W	W	3	3	3	8	8	8	2	2	2	2	2	2
04/08/2020	3	18:20	21:20	3	3	3	W	W	W	2	2	2	8	8	8	2	2	2	2	2	2
05/08/2020	1	05:50	08:50	3	3	3	NW	W	W	0	0	0	7	7	8	2	2	2	2	2	2
05/08/2020	1	09:20	12:20	3	2	2	S	S	W	0	0	2	7	7	7	2	2	2	2	2	2
06/08/2020	2	05:35	08:35	2	3	3	W	W	W	0	0	0	7	5	5	2	2	2	2	2	2
06/08/2020	2	09:05	12:05	3	3	3	SW	SW	SW	0	0	0	7	7	5	2	2	2	2	2	2
2021 start																					
30/03/2021	2	08:45	11:45	3	3	3	SW	SW	SW	0	0	0	7	7	7	2	2	2	2	2	2
30/03/2021	1	08:50	11:50	3	3	3	S	S	S	0	0	0	7	7	7	2	2	2	2	2	2
30/03/2021	2	12:15	15:15	3	3	3	S	S	S	0	0	0	7	7	7	2	2	2	2	2	2
30/03/2021	1	12:20	15:20	3	3	3	S	S	S	0	0	0	7	7	7	2	2	2	2	2	2
31/03/2021	3	10:15	13:15	2	2	3	S	S	S	2	2	0	8	8	8	2	2	2	2	2	2

				Wind speed			Direction			Rain			Cloud cover			Cloud height			Visibility		
Date	VP	Start	End	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
31/03/2021	3	13:45	16:45	2	2	2	S	S	S	0	0	0	8	8	8	1	1	1	1	1	1
20/04/2021	2	08:45	11:45	2	3	3	W	W	W	0	0	2	8	8	8	2	2	1	2	2	1
20/04/2021	2	12:15	15:15	3	3	3	W	W	NW	2	0	0	8	8	8	1	1	2	1	1	2
21/04/2021	1	12:05	15:05	3	4	4	E	E	E	0	0	0	0	0	0	2	2	2	2	2	2
21/04/2021	1	15:35	18:35	3	2	2	E	E	E	0	0	0	0	0	0	2	2	2	2	2	2
22/04/2021	3	10:45	13:45	4	3	2	SE	SE	SE	0	0	0	5	3	1	2	2	2	2	2	2
22/04/2021	3	14:15	17:15	3	3	3	SE	SE	SE	0	0	0	1	1	1	2	2	2	2	2	2
11/05/2021	2	12:30	15:30	4	3	3	SE	SE	SE	0	0	0	5	5	5	2	2	2	2	2	2
11/05/2021	2	16:00	19:00	3	3	3	SE	SE	SE	0	0	0	5	3	3	2	2	2	2	2	2
12/05/2021	1	11:00	14:00	1	1	1	W	W	W	2	0	0	7	7	7	2	2	2	2	2	2
12/05/2021	1	14:30	17:30	1	2	2	W	W	W	0	2	2	7	7	7	2	2	2	2	2	2
20/05/2021	3	11:10	14:10	4	5	5	E	E	E	2	2	2	8	8	8	2	2	2	2	2	2
20/05/2021	3	14:40	17:40	5	5	5	E	E	E	2	2	2	8	8	8	2	2	2	2	2	2
16/06/2021	2	07:10	10:10	3	4	4	S	S	S	0	0	0	7	7	7	2	2	2	2	2	2
16/06/2021	2	10:40	13:40	4	4	3	S	S	S	0	0	0	6	7	6	2	2	2	2	2	2
22/06/2021	3	14:50	17:50	3	3	3	W	W	W	0	0	0	3	3	5	2	2	2	2	2	2
22/06/2021	3	18:20	21:20	3	3	4	W	W	W	0	1	2	5	7	8	2	2	2	2	2	2
24/06/2021	1	06:15	09:15	3	3	3	W	W	W	2	2	2	8	8	8	1	1	1	1	1	1
24/06/2021	1	09:45	12:45	3	3	3	W	W	W	2	2	2	8	8	8	1	1	1	1	1	1
26/07/2021	3	14:00	17:00	2	2	3	W	W	W	0	0	0	8	8	8	2	2	2	2	2	2
26/07/2021	3	17:30	20:30	3	3	3	W	W	W	0	0	2	8	8	8	1	1	1	1	1	1
28/07/2021	2	09:10	12:10	3	3	3	W	W	W	0	0	0	7	7	7	1	2	2	2	2	2
28/07/2021	1	09:45	12:45	3	3	3	W	W	W	0	0	0	7	7	7	2	2	1	2	2	2
28/07/2021	2	12:40	15:40	2	3	3	W	W	W	0	0	0	7	7	7	2	2	2	2	2	2
28/07/2021	1	13:15	16:15	3	3	3	W	W	W	0	0	0	7	7	8	2	1	1	2	2	1
16/08/2021	1	13:35	16:35	4	4	4	W	W	W	0	0	0	8	8	8	2	2	2	2	2	2
16/08/2021	1	17:05	20:05	4	4	4	W	W	W	0	1	2	8	8	8	2	1	1	2	1	1
18/08/2021	2	06:15	09:15	3	4	4	W	W	W	0	0	0	7	7	7	1	1	1	1	1	1
18/08/2021	2	17:00	20:00	3	4	4	W	W	W	0	0	0	8	8	8	2	2	2	2	2	2
20/08/2021	3	06:20	09:20	3	4	4	W	W	W	0	0	0	7	7	7	2	2	2	2	2	2
20/08/2021	3	09:50	12:50	3	3	3	W	W	W	0	0	2	7	8	8	2	2	2	2	2	2
Old data 2014-2016																					
21/11/2014	1	10:10	13:10	4	4	5	E	E	E	0	0	0	8	8	8	2	2	2	2	2	2
21/11/2014	1	13:40	16:40	4	4	5	E	E	E	0	0	2	8	8	8	2	2	2	2	2	2
22/11/2014	3	10:00	13:00	4	4	4	SW	SW	SW	0	0	3	7	7	8	2	2	1	2	2	2
22/11/2014	3	13:30	16:45	3	3	2	SW	SW	SW	2	0	3	7	5	5	2	2	2	2	2	2
23/11/2014	1	08:20	11:20	3	3	3	SW	W	W	0	0	0	5	5	5	2	2	2	2	2	2

				Wind speed			Direction			Rain			Cloud cover			Cloud height			Visibility		
Date	VP	Start	End	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
23/11/2014	3	13:00	16:00	3	3	3	W	W	W	2	0-3	0	7	7	5	2	2	2	2	2	2
26/11/2014	2	09:00	12:30	3	3	3	E	E	E	0	0	0	5	3	3	2	2	2	2	2	2
26/11/2014	2	13:00	16:30	2	3	2	E	E	E	0	0	0	5	3	1	2	2	2	2	2	2
06/12/2014	2	10:30	13:30	4	4	5	W	W	W	0	2	2	7	8	8	2	2	1	2	2	2
06/12/2014	2	14:00	16:00	5	5		W	W		2	0		8	8		2	2		2	2	
07/12/2014	3	10:15	13:15	5	5	6	W	W	W	0	0/3	0/3	5	7	7	2	2	2	2	2	2
07/12/2014	2	13:45	16:45	5	4	4	W	W	W	3	0	3	7	5	7	2	2	2	2	2	1
08/12/2014	3	10:15	13:15	4	4	3	NW	NW	N	0/3	0/3	0/3	7	5	7	2	2	2	2	2	2
08/12/2014	3	13:45	16:45	4	3	3	NW	NW	NW	0/2	0	0/2	8	8	8	2	2	2	2	2	1
09/12/2014	3	08:30	11:30	5	5	5	SSW	SSW	SSW	0	2	2/3	7	7	7	2	2	2	2	2	1
09/12/2014	1	12:55	15:55	5	5	5	SSW	SSW	SSW	2	2	3	8	8	8	2	2	1	2	2	1
10/12/2014	1	09:30	11:30	6	6	6	W	W	W	0/2/3	2	0	7	5	5	2	2	2	2	2	2
10/12/2014	1	11:50	15:50	2	2	2	W	W	W	0	0	0	8	8	8	2	2	2	2	2	2
19/01/2015	3	10:30	13:30	2	3	3	SE	SE	SE	0	0	0	1	3	3	2	2	2	2	2	2
19/01/2015	3	14:30	17:30	3	3	3	ESE	ESE	ESE	0	0	0	5	5	5	2	2	2	2	2	2
20/01/2015	2	10:00	13:00	4	4	4	SE	SE	SE	0	0	0	7	7	7	2	2	2	2	2	2
20/01/2015	2	13:30	16:45	4	4	4	SSE	SSE	SSE	0	2	2	7	8	8	2	1	1	2	1	1
21/01/2015	2	08:15	11:15	3	3	3	SSE	SSE	SSE	0	0	0	1	3	1	2	2	2	2	2	2
21/01/2015	3	13:00	16:00	3	2	3	SSE	SSE	SSE	0	0	0	3	3	3	2	2	2	2	2	2
22/01/2015	1	10:05	13:05	3	3	2	SE	SE	SE	0	0	0	1	3	1	2	2	2	2	2	2
22/01/2015	1	13:20	16:50	3	3	3	SE	SE	SE	0	0	0	1	1	1	2	2	2	2	2	2
23/01/2015	3	10:00	12:30	4	4		SW	SW		0	0		7	7		2	2		2	2	
23/01/2015	3	12:50	14:50	4	4		W	W		2	2		8	8		2	2		2	2	
09/02/2015	1	10:45	14:15	4	4	4	W	W	W	0	0	1	7	7	7	2	2	2	2	2	2
09/02/2015	1	14:45	17:45	4	3	3	W	W	W	0	1	1	8	8	8	1	1	1	1	1	1
10/02/2015	1	08:40	11:40	3	3		SW	SW		0	0	0	8	8		2	1		2	2	
10/02/2015	1	12:10	14:10	3	2		SW	SW		0	0		8	8		2	2		2	2	
10/02/2015	1	14:40	16:40	2	2		SW	SW		0	0		8	8		2	2		2	2	
11/02/2015	3	08:35	11:05	4	4		SW	SW		0	0		8	8		1	1		2	2	
11/02/2015	3	11:35	13:35	4	3		SW	W		0	0		8	7		1	2		2	2	
11/02/2015	2	15:30	18:00	4	4	3	SW	SW	SW	0	0	0	8	8	8	2	2	2	2	2	2
12/02/2015	2	07:15	10:15	4	4	4	S	S	S	0	0	0	8	8	7	2	2	2	2	2	2
12/02/2015	2	10:45	14:15	4	3	3	S	S	S	0	0	0	8	8	8	2	2	2	2	2	2
05/03/2015	3	13:00	15:00	4	4		S	S		0	0		7	7		2	2		2	2	
05/03/2015	3	15:30	18:00	4	4		SSW	SSW		0	2		8	8		2	2		2	2	
06/03/2015	1	08:05	11:05	5	5	5	S	S	S	0	0	0	8	8	8	2	2	2	2	2	2
06/03/2015	1	11:35	14:35	5	5	5	S	SSW	SSW	0	0	0	8	8	8	2	2	2	2	2	2
09/03/2015	3	13:10	15:10	6	6		SSE	S		0	2		8	8		2	2		2	2	

				Wind speed			Direction			Rain			Cloud cover			Cloud height			Visibility		
Date	VP	Start	End	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
09/03/2015	3	15:40	18:10	6	6		SSW	SSW		0	0		7	7		2	2		2	2	
10/03/2015	2	07:30	10:30	4	4	4	W	W	W	0	0	0	7	7	5	2	2	2	2	2	2
10/03/2015	2	11:00	14:00	4	4	3	W	W	W	0	0	0	3	3	3	2	2	2	2	2	2
11/03/2015	1	06:25	09:25	5	5	6	SSE	SSE	SSE	0	0	2	7	8	8	2	2	2	2	2	2
11/03/2015	2	14:25	17:25	4	4	3	W	W	W	2	0	0	7	5	3	2	2	2	2	2	2
06/04/2015	3	10:05	13:05	2	3	3	W	W	W	0	0	0	3	3	1	2	2	2	2	2	2
06/04/2015	3	13:35	16:35	3	2	2	W	W	W	0	0	0	1	3	3	2	2	2	2	2	2
07/04/2015	1	11:10	14:10	3	3	3	W	W	W	0	0	0	8	7	7	2	2	2	2	2	2
07/04/2015	1	14:40	16:10	3	3		W	W		0	0		7	5		2	2		2	2	
08/04/2015	3	06:30	09:30	3	4	3	E	SE	E	0	0	0	3	1	1	2	2	2	2	2	2
09/04/2015	2	06:25	09:25	3	3	3	S	S	S	0	0	0	1	1	1	2	2	2	2	2	2
09/04/2015	2	10:00	13:00	4	4	3	S	S	S	0	0	0	1	1	1	2	2	2	2	2	2
10/04/2015	1	09:40	12:40	4	4	4	SE	SE	SE	0	0	0	1	3	5	2	2	2	2	2	2
10/04/2015	1	13:10	14:40	4	4		SE	SE		0	0		5	5		2	2		2	2	
10/04/2015	2	16:25	19:25	4	3	3	SE	SE	SE	0	0	0	5	7	7	2	2	2	2	2	2
18/05/2015	1	10:15	13:15	3	4	4	W	W	W	0	0	0	5	7	7	2	2	2	2	2	2
18/05/2015	1	13:45	16:45	4	3	3	W	W	W	0	0	0	5	7	5	2	2	2	2	2	2
19/05/2015	1	06:25	09:25	5	5	5	NW	NW	W	2	0	0	7	5	7	2	2	2	2	2	2
19/05/2015	2	16:05	19:05	5	5	5	NW	NW	NW	2	0	2	7	7	7	2	2	2	2	2	2
20/05/2015	3	06:30	09:30	5	4	4	NW	NW	NW	2	0	0	7	7	7	2	2	2	2	2	2
20/05/2015	3	10:00	13:00	4	4	4	NW	NW	NW	0	0	0	7	7	5	2	2	2	2	2	2
21/05/2015	2	06:25	09:25	4	3	3	W	W	W	2	2	0	8	8	7	2	2	2	2	2	2
21/05/2015	2	09:55	12:55	3	4	4	W	W	W	0	0	2	8	8	8	2	2	2	2	2	2
22/05/2015	3	10:00	13:00	4	4	4	W	W	W	2	2	0	8	8	8	1	1	2	1	2	2
08/06/2015	1	14:30	17:30	4	4	4	NW	NW	NW	0	0	0	3	1	1	2	2	2	2	2	2
08/06/2015	1	18:00	21:00	4	3	3	NW	NNW	NNW	0	0	0	1	1	1	2	2	2	2	2	2
09/06/2015	3	06:55	09:55	2	2	3	NW	NW	W	0	0	0	3	5	7	2	2	2	2	2	2
09/06/2015	3	10:25	13:25	3	2	3	NW	NW	NW	0	0	0	7	5	5	2	2	2	2	2	2
10/06/2015	1	05:10	08:10	3	3	3	NW	NW	NW	0	0	0	1	1	1	2	2	2	2	2	2
10/06/2015	3	16:05	19:05	4	3	3	NW	NW	NW	0	0	0	1	1	1	2	2	2	2	2	2
11/06/2015	2	04:20	07:20	1	1	2	W	W	W	0	0	0	1	1	1	2	2	2	2	2	2
11/06/2015	2	07:50	10:50	2	2	3	W	W	W	0	0	0	1	3	1	2	2	2	2	2	2
11/06/2015	2	19:20	22:20	2	2	2	W	W	W	0	0	0	1	1	1	2	2	2	2	2	2
13/07/2015	1	05:05	08:05	3	2	2	S	SW	W	1	1	1	8	8	8	1	1	1	1	2	2
13/07/2015	1	14:15	17:15	3	4	3	W	W	W	0	1	0	8	8	7	2	2	2	2	2	2
14/07/2015	3	09:20	12:20	2	3	2	W	W	NW	0	0	0	7	5	5	2	2	2	2	2	2
14/07/2015	3	12:50	15:50	2	2	2	W	W	W	0	0	0	3	5	7	2	2	2	2	2	2
14/07/2015	1	18:50	21:50	3	4	3	NW	NW	NW	0	0	0	5	7	7	2	2	2	2	2	2

				Wind speed			Direction			Rain			Cloud cover			Cloud height			Visibility		
Date	VP	Start	End	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
15/07/2015	2	09:45	12:45	3	3	3	NW	NW	NW	0	0	0	5	7	5	2	2	2	2	2	2
15/07/2015	2	13:15	16:15	3	3	2	NW	NW	NW	0	0	0	3	3	3	2	2	2	2	2	2
15/07/2015	3	19:05	22:05	2	3	3	NW	NW	NW	0	0	0	3	3	3	2	2	2	2	2	2
17/07/2015	2	05:15	08:15	4	5	5	SW	S	S	2	0	2	7	7	8	1	2	2	2	2	2
24/08/2015	1	06:25	09:25	2	3	3	SE	SE	S	0	0	0	5	5	5	2	2	2	2	2	2
24/08/2015	1	09:55	11:55	3	2	2	SE	SE	SE	0	0	0	5	5	5	2	2	2	2	2	2
25/08/2015	3	08:00	11:00	2	2	2	SW	SW	SW	0	0	0	5	3	3	2	2	2	2	2	2
25/08/2015	3	11:30	14:30	3	3	3	SSW	SW	SW	0	0	0	3	5	7	2	2	2	2	2	2
25/08/2015	1	17:25	20:25	3	4	4	S	SSE	SSE	0	0	0	3	5	7	2	2	2	2	2	2
26/08/2015	2	11:00	14:00	2	3	2	SW	SW	SW	2	0	0	7	5	5	2	2	2	2	2	2
26/08/2015	2	14:30	17:30	2	3	3	SW	SW	SW	0	2	0	5	7	7	2	2	2	2	2	2
27/08/2015	2	06:25	09:25	5	4	4	SW	SW	SW	2	2	2	8	8	8	2	2	1	2	2	1
27/08/2015	3	14:00	17:00	4	3	3	SW	SW	SW	0	0	3	5	5	8	2	2	2	2	2	2
03/09/2015	1	07:30	10:30	4	4	5	NW	NW	NW	0	2	0	7	7	5	2	2	2	2	2	2
03/09/2015	1	11:00	14:00	4	4	4	NW	NW	NW	0	0	0	5	7	5	2	2	2	2	2	2
03/09/2015	1	14:30	17:30	4	4	4	NW	NW	NW	0	0	0	5	5	5	2	2	2	2	2	2
17/09/2015	2	06:35	09:35	2	2	2	W	W	W	0	0	0	3	3	3	2	2	2	2	2	2
17/09/2015	3	10:50	13:50	2	2	3	W	W	W	0	0	0	1	3	5	2	2	2	2	2	2
17/09/2015	3	14:20	17:20	3	3	3	W	W	W	0	0	0	4	7	7	2	2	2	2	2	2
18/09/2015	3	06:30	09:30	2	2	3	N	N	N	0	0	0	1	3	3	2	2	2	2	2	2
18/09/2015	2	10:40	13:40	2	3	2	N	N	N	0	0	0	3	3	3	2	2	2	2	2	2
18/09/2015	2	14:10	17:10	2	3	3	N	N	N	0	0	0	3	3	3	2	2	2	2	2	2
26/10/2015	1	11:30	14:30	5	5	6	SE	SE	SE	0	0	0	8	8	7	2	2	2	2	2	2
26/10/2015	1	15:00	18:00	5	5	5	SE	SE	SE	0	0	0	7	7	7	2	2	2	2	2	2
27/10/2015	1	07:00	10:00	4	5	5	E	E	E	0	0	0	5	5	5	2	2	2	2	2	2
27/10/2015	2	11:25	14:25	4	5	5	E	E	E	0	0	0	3	5	5	2	2	2	2	2	2
27/10/2015	2	14:55	17:55	4	5	5	E	E	E	0	0	0	5	5	7	2	2	2	2	2	1
28/10/2015	2	08:05	11:05	3	3	3	E	E	E	0	2	2	8	8	8	2	2	2	2	2	2
28/10/2015	3	12:25	15:25	4	3	3	E	E	E	0	0	2	7	8	8	2	2	2	2	2	2
28/10/2015	3	15:55	17:55	3	4		E	E		0	0		8	8		1	2		2	1	
29/10/2015	3	09:15	12:15	4	4	4	WSW	WSW	WSW	0	0	0	5	3	3	2	2	2	2	2	2
29/10/2015	3	12:45	13:45	4			WSW			0			1			2			2		
09/11/2015	1	10:55	13:55	5	5	5	SW	SW	SW	2	2	3	8	8	8	2	2	2	2	2	2
09/11/2015	1	14:25	17:25	5	4	3	SW	SW	SW	2	3	2	8	8	8	1	1	1	2	2	1
10/11/2015	2	07:00	10:00	5	5	5	SW	SW	SW	3	3	3	8	8	8	1	1	1	2	2	2
10/11/2015	1	14:20	17:20	5	4	3	SW	SW	SW	2	0	0	8	8	8	1	2	1	2	2	1
11/11/2015	2	10:55	13:55	5	4	4	SW	SW	SW	2	0	2	8	8	8	2	2	1	2	2	1
11/11/2015	2	14:25	17:25	5	5	5	SW	SW	W	0	2	0	7	5	5	2	2	2	2	2	2

				Wind speed			Direction			Rain			Cloud cover			Cloud height			Visibility		
Date	VP	Start	End	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
12/11/2015	3	08:00	10:00	5	6		S	S		0	0		8	8		2	2		2	2	
12/11/2015	3	10:30	12:30	5	6		S	S		0	0		7	7		2	2		2	2	
13/11/2015	3	08:20	11:20	6	5	5	W	W	W	0	2	3	7	7	7	2	2	1	2	2	2
13/11/2015	3	11:50	13:50	5	5		W	W		3	2		7	5		2	2		2	2	
07/12/2015	1	10:10	13:10	6	6	5	SE	SE	SSE	2	2	2	8	8	8	1	1	1	1	2	2
07/12/2015	1	13:40	16:40	5	5	5	SE	SE	S	2	0	2	8	8	8	1	1	1	2	2	1
08/12/2015	2	09:00	11:00	5	5		SSE	SSE		0	0		6	3		2	2		2	2	
08/12/2015	2	11:30	13:30	5	5		S	S		0	0		6	7		2	2		2	2	
08/12/2015	2	14:00	17:00	5	5	4	SW	W	W	2	2	2	7	8	7	2	1	2	2	2	1
09/12/2015	2	07:45	09:45	5	5		SSW	SSW		0	2		8	8		2	1		2	2	
09/12/2015	1	12:10	14:10	5	6		SSW	SSW		0	2		7	8		2	2		2	2	
09/12/2015	1	14:40	16:40	6	6		SSW	SSW		0	2		7	7		2	2		2	2	
10/12/2015	3	12:20	14:20	5	5		WSW	WSW		0	2		7	5		2	2		2	2	
10/12/2015	3	14:50	16:50	5	5		WSW	WSW		0	0		7	7		2	2		2	2	
11/12/2015	3	07:45	10:45	6	6	5	WSW	W	W	2	2	0	8	7	7	1	2	2	1	2	2
11/12/2015	3	11:15	13:15	4	5		W	W		2	0		7	7		2	2		2	2	
18/01/2016	3	09:05	11:35	5	5		SW	SW		2	2		8	8		1	1		2	2	
18/01/2016	3	12:05	14:05	5	5		SW	SW		2	2		8	8		1	1		2	2	
18/01/2016	2	15:30	17:30	5	4		SW	SW		2	2		8	8		1	1		2	1	
19/01/2016	1	11:00	14:00	2	2	3	E	E	E	0	0	0	8	7	7	2	2	2	2	2	2
19/01/2016	1	14:30	17:30	3	3	3	E	E	E	0	0	0	7	8	8	2	2	1	2	2	1
20/01/2016	2	09:30	11:30	3	3		SE	SE		2	2		8	7		1	2		1	2	
20/01/2016	2	12:00	14:00	3	4		SE	SE		0	0		7	7		2	2		2	2	
20/01/2016	2	14:30	17:30	3	3	3	SE	SE	SE	2	0	0	8	8	8	2	2	1	2	2	1
21/01/2016	1	09:35	12:35	5	5	5	SE	SE	SE	2	2	2	8	8	8	1	1	1	2	2	1
22/01/2016	3	07:30	10:00	5	4		S	SW		2	2		8	7		1	2		1	2	
22/01/2016	3	10:30	12:30	4	4		SW	SW		0	0		3	1		2	2		2	2	
08/02/2016	3	09:25	12:25	4	3	4	W	W	W	2	0	2	8	5	7	2	2	2	2	2	2
08/02/2016	3	12:55	14:55	4	4		W	W		2	3		7	7		2	2		2	2	
08/02/2016	1	16:10	17:40	2	3		W	W		2	0		7	7		2	2		2	1	
09/02/2016	1	08:35	11:35	4	3	3	W	W	W	2	2	2	8	8	8	1	1	1	1	2	2
09/02/2016	1	12:05	14:05	3	3		W	NW		0	0		7	7		2	2		2	2	
09/02/2016	1	14:35	16:35	3	3		NW	NW		0	0		5	5		2	2		2	2	
10/02/2016	2	13:45	15:45	3	3		NW	NW		0	0		5	5		2	2		2	2	
10/02/2016	2	16:15	18:15	3	3		NW	NW		2	0		5	5		2	2		2	2	
11/02/2016	3	07:00	09:00	3	2		WNW	WNW		0	0		1	1		2	2		2	2	
11/02/2016	3	09:30	11:30	2	2		WNW	WNW		0	0		3	3		2	2		2	2	
12/02/2016	2	06:50	08:50	3	3		E	E		0	0		3	3		2	2		1	2	

				Wind speed			Direction			Rain			Cloud cover			Cloud height			Visibility		
Date	VP	Start	End	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
09/03/2016	3	16:10	19:10	3	3	3	NW	NW	NW	0	0	2	7	5	5	1	2	2	2	2	2
10/03/2016	1	08:45	11:45	3	3	3	SE	SE	SE	0	0	0	1	1	1	2	2	2	2	2	2
10/03/2016	1	12:15	15:15	3	2	3	SE	SE	SE	0	0	0	1	3	3	2	2	2	2	2	2
10/03/2016	1	16:20	18:20	3	3		SE	SE		0	0		5	5		2	2		2	2	
11/03/2016	2	05:55	08:55	3	3	3	SE	SE	SSE	0	2	2	7	7	8	2	2	2	2	2	2
11/03/2016	2	09:25	12:25	3	3	3	SSE	SSE	SSE	2	2	2	8	8	8	2	2	2	2	2	2
15/03/2016	1	15:00	18:00	3	3	4	ENE	ENE	ENE	0	0	0	3	3	3	2	2	2	2	2	2
16/03/2016	2	15:40	18:40	3	3	3	E	E	E	0	0	0	3	5	3	2	2	2	2	2	2
17/03/2016	3	12:25	14:25	2	2		S	SW		0	0		3	1		2	2		2	2	
17/03/2016	3	14:55	16:55	2	2		W	W		0	0		3	3		2	2		2	2	
04/04/2016	2	05:55	08:55	3	3	3	NW	NW	NW	2	2	2	8	8	8	2	2	2	2	2	2
04/04/2016	1	11:00	14:00	3	3	3	NW	NW	W	2	2	2	8	8	8	2	2	2	2	2	2
04/04/2016	1	14:30	17:30	3	3	3	N	N	N	2	2	0	8	8	8	2	2	2	2	2	2
05/04/2016	3	05:55	08:55	4	3	3	W	W	W	2	2	0	8	8	8	1	2	2	2	2	2
05/04/2016	2	12:15	15:15	3	3	3	W	W	NW	2	0	0	7	5	5	2	2	2	2	2	2
05/04/2016	2	15:45	18:45	3	3	3	W	W	W	0	0	0	3	5	5	2	2	2	2	2	2
06/04/2016	3	09:30	12:30	4	4	4	W	W	W	3	3	3	8	8	8	2	2	2	2	2	2
06/04/2016	3	13:00	16:00	3	3	3	W	W	W	0	2	2	7	8	8	2	2	2	2	2	2
06/04/2016	1	18:08	21:08	3	3	3	W	W	W	2	0	0	7	7	7	2	2	2	2	2	2

Appendix 2. Detailed collision risk calculations and species-specific calculations (2014 – 2016) taken from Annexes 1 to 9 of Appendix 10.1 (Environmental Statement Volume 3) of the 2016 EIA

Annex 1: Golden Plover Collision Risk Probability

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
NoBlades	3					Upwind:			Downwind:		
MaxChord	3.5	m	r/R	c/C	α	collide		contribution	collide		contribution
Pitch (degrees)	15		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.28	m	0.025	0.575	8.64	23.52	1.00	0.00125	22.48	0.98	0.00123
Wingspan	0.72	m	0.075	0.575	2.88	8.19	0.36	0.00269	7.15	0.31	0.00235
F: Flapping (0) or gliding (+1)	0		0.125	0.702	1.73	5.97	0.26	0.00327	4.70	0.21	0.00258
			0.175	0.860	1.23	5.25	0.23	0.00403	3.70	0.16	0.00283
Bird speed	13.7	m/sec	0.225	0.994	0.96	4.82	0.21	0.00475	3.02	0.13	0.00297
RotorDiam	101	m	0.275	0.947	0.79	3.94	0.17	0.00474	2.22	0.10	0.00267
RotationPeriod	5.00	sec	0.325	0.899	0.66	3.31	0.15	0.00471	1.68	0.07	0.00240
			0.375	0.851	0.58	2.84	0.12	0.00467	1.30	0.06	0.00214
			0.425	0.804	0.51	2.47	0.11	0.00460	1.02	0.04	0.00189
			0.475	0.756	0.45	2.17	0.10	0.00452	0.80	0.04	0.00167
Bird aspect ratio: β	0.39		0.525	0.708	0.41	1.92	0.08	0.00442	0.64	0.03	0.00147
			0.575	0.660	0.38	1.72	0.08	0.00432	0.52	0.02	0.00131
			0.625	0.613	0.35	1.55	0.07	0.00424	0.44	0.02	0.00121
			0.675	0.565	0.32	1.40	0.06	0.00415	0.38	0.02	0.00112
			0.725	0.517	0.30	1.27	0.06	0.00403	0.33	0.01	0.00105
			0.775	0.470	0.28	1.15	0.05	0.00390	0.30	0.01	0.00101
			0.825	0.422	0.26	1.04	0.05	0.00374	0.29	0.01	0.00104
			0.875	0.374	0.25	0.93	0.04	0.00357	0.31	0.01	0.00118
			0.925	0.327	0.23	0.83	0.04	0.00338	0.32	0.01	0.00129
			0.975	0.279	0.22	0.74	0.03	0.00317	0.32	0.01	0.00138
				Overall p(collision) =			Upwind	7.8%		Downwind	3.5%
								Average	5.6%		

Annex 2: Golden Eagle Collision Risk Probability

K: [1D or [3D] (0 or 1)	1		**Calculation of alpha and p(collision) as a function of radius**								
NoBlades	3					Upwind:			Downwind:		
MaxChord	3.5	m	r/R	c/C	α	collide		contribution	collide		contribution
Pitch (degrees)	15		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.815	m	0.025	0.575	9.45	38.94	1.00	0.00125	37.90	1.00	0.00125
Wingspan	2.12	m	0.075	0.575	3.15	13.33	0.53	0.00400	12.29	0.49	0.00369
F: Flapping (0) or gliding (+1)	0		0.125	0.702	1.89	9.13	0.37	0.00456	7.86	0.31	0.00393
			0.175	0.860	1.35	7.57	0.30	0.00530	6.01	0.24	0.00421
Bird speed	15	m/sec	0.225	0.994	1.05	6.66	0.27	0.00599	4.86	0.19	0.00437
RotorDiam	101	m	0.275	0.947	0.86	5.43	0.22	0.00597	3.72	0.15	0.00409
RotationPeriod	5.00	sec	0.325	0.899	0.73	4.57	0.18	0.00594	2.94	0.12	0.00382
			0.375	0.851	0.63	3.92	0.16	0.00588	2.38	0.10	0.00357
			0.425	0.804	0.56	3.42	0.14	0.00581	1.96	0.08	0.00334
			0.475	0.756	0.50	3.01	0.12	0.00572	1.64	0.07	0.00312
Bird aspect ratio: β	0.38		0.525	0.708	0.45	2.67	0.11	0.00562	1.39	0.06	0.00292
			0.575	0.660	0.41	2.39	0.10	0.00549	1.19	0.05	0.00274
			0.625	0.613	0.38	2.15	0.09	0.00538	1.04	0.04	0.00261
			0.675	0.565	0.35	2.00	0.08	0.00539	0.97	0.04	0.00262
			0.725	0.517	0.33	1.85	0.07	0.00538	0.92	0.04	0.00266
			0.775	0.470	0.30	1.72	0.07	0.00535	0.87	0.03	0.00271
			0.825	0.422	0.29	1.61	0.06	0.00530	0.84	0.03	0.00278
			0.875	0.374	0.27	1.50	0.06	0.00524	0.82	0.03	0.00286
			0.925	0.327	0.26	1.39	0.06	0.00515	0.83	0.03	0.00307
			0.975	0.279	0.24	1.30	0.05	0.00505	0.84	0.03	0.00327
				Overall p(collision) =			**Upwind**	**10.4%**		**Downwind**	**6.4%**
								Average	**8.4%**		

Annex 3: Hen Harrier Collision Risk Probability

K: [1D or [3D] (0 or 1)	1		**Calculation of alpha and p(collision) as a function of radius**								
NoBlades	3					Upwind:			Downwind:		
MaxChord	3.5	m	r/R	c/C	α	collide		contribution	collide		contribution
Pitch (degrees)	15		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.48	m	0.025	0.575	7.56	23.54	1.00	0.00125	22.50	1.00	0.00125
Wingspan	1.1	m	0.075	0.575	2.52	8.20	0.41	0.00307	7.15	0.36	0.00268
F: Flapping (0) or gliding (+1)	0		0.125	0.702	1.51	5.89	0.29	0.00368	4.62	0.23	0.00289
			0.175	0.860	1.08	5.11	0.26	0.00447	3.55	0.18	0.00311
Bird speed	12	m/sec	0.225	0.994	0.84	4.65	0.23	0.00523	2.85	0.14	0.00321
RotorDiam	101	m	0.275	0.947	0.69	3.81	0.19	0.00525	2.10	0.10	0.00289
RotationPeriod	5.00	sec	0.325	0.899	0.58	3.22	0.16	0.00524	1.59	0.08	0.00259
			0.375	0.851	0.50	2.78	0.14	0.00521	1.23	0.06	0.00232
			0.425	0.804	0.44	2.43	0.12	0.00516	0.97	0.05	0.00206
			0.475	0.756	0.40	2.18	0.11	0.00518	0.81	0.04	0.00193
Bird aspect ratio: β	0.44		0.525	0.708	0.36	1.98	0.10	0.00521	0.70	0.04	0.00184
			0.575	0.660	0.33	1.81	0.09	0.00521	0.62	0.03	0.00177
			0.625	0.613	0.30	1.66	0.08	0.00519	0.55	0.03	0.00172
			0.675	0.565	0.28	1.53	0.08	0.00515	0.50	0.03	0.00170
			0.725	0.517	0.26	1.40	0.07	0.00509	0.49	0.02	0.00179
			0.775	0.470	0.24	1.29	0.06	0.00501	0.52	0.03	0.00201
			0.825	0.422	0.23	1.19	0.06	0.00491	0.54	0.03	0.00221
			0.875	0.374	0.22	1.09	0.05	0.00478	0.55	0.03	0.00239
			0.925	0.327	0.20	1.00	0.05	0.00463	0.55	0.03	0.00254
			0.975	0.279	0.19	0.92	0.05	0.00446	0.55	0.03	0.00268
				Overall p(collision) =			**Upwind**	**9.3%**		**Downwind**	**4.6%**
								Average	**6.9%**		

Annex 4: Kestrel Collision Risk Probability

K: [1D or [3D] (0 or 1)	1		**Calculation of alpha and p(collision) as a function of radius**								
NoBlades	3					Upwind:			Downwind:		
MaxChord	3.5	m	r/R	c/C	α	collide		contribution	collide		contribution
Pitch (degrees)	15		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.35	m	0.025	0.575	6.37	17.54	1.00	0.00125	16.50	0.98	0.00123
Wingspan	0.73	m	0.075	0.575	2.12	6.20	0.37	0.00276	5.15	0.31	0.00230
F: Flapping (0) or gliding (+1)	0		0.125	0.702	1.27	4.58	0.27	0.00340	3.31	0.20	0.00246
			0.175	0.860	0.91	4.09	0.24	0.00425	2.53	0.15	0.00263
Bird speed	10.1	m/sec	0.225	0.994	0.71	3.79	0.23	0.00507	1.99	0.12	0.00266
RotorDiam	101	m	0.275	0.947	0.58	3.13	0.19	0.00512	1.42	0.08	0.00232
RotationPeriod	5.00	sec	0.325	0.899	0.49	2.66	0.16	0.00514	1.03	0.06	0.00199
			0.375	0.851	0.42	2.34	0.14	0.00522	0.80	0.05	0.00178
			0.425	0.804	0.37	2.10	0.12	0.00529	0.64	0.04	0.00161
			0.475	0.756	0.34	1.89	0.11	0.00534	0.52	0.03	0.00147
Bird aspect ratio: β	0.44		0.525	0.708	0.30	1.72	0.10	0.00536	0.43	0.03	0.00135
			0.575	0.660	0.28	1.57	0.09	0.00535	0.37	0.02	0.00126
			0.625	0.613	0.25	1.43	0.09	0.00532	0.38	0.02	0.00140
			0.675	0.565	0.24	1.31	0.08	0.00526	0.41	0.02	0.00165
			0.725	0.517	0.22	1.20	0.07	0.00518	0.43	0.03	0.00187
			0.775	0.470	0.21	1.10	0.07	0.00507	0.45	0.03	0.00207
			0.825	0.422	0.19	1.01	0.06	0.00494	0.46	0.03	0.00224
			0.875	0.374	0.18	0.92	0.05	0.00478	0.46	0.03	0.00239
			0.925	0.327	0.17	0.84	0.05	0.00459	0.46	0.03	0.00250
			0.975	0.279	0.16	0.76	0.04	0.00438	0.45	0.03	0.00260
				Overall p(collision) =			**Upwind**	**9.3%**		**Downwind**	**4.0%**
								Average	**6.6%**		

Annex 5: Detailed collision risk calculations

VP survey effort based on weighted effort per unit area per unit time for golden plover.

	Watch data		
VP	Area (ha)	Time (hrs)	HaHr
1	341.3	121.5	41,468.0
2	113.3	111.3	12,604.6
3	260.1	118.3	30,756.8
Totals	714.7	351.0	84,829.4

VP survey effort based on weighted effort per unit area per unit time for golden eagle, hen harrie kestrel.

	Watch data		
VP	Area (ha)	Time (hrs)	HaHr
1	341.3	165.5	56,485.2
2	113.3	156.3	17,708.8
3	260.1	163.3	42,474.3
Totals	714.7	485.1	116,668.3

Wind farm area (ha) 582.45

14 Turbines

Vw = 588,274,500 m^3

Daylight hours (estimate) at 55.62N: 4,484 (annual) and 2,173 (October 1st - April 30th).

Wind farm down time 15%

Annex 6: Species-specific calculations

Golden Plover

Flying time (s)	Flying time hahr	Weighted flying time hahr	
Risk height	Risk height	Weighting	Risk height
406	0.0000027196	0.488839365	0.000001329
0	0.0000000000	0.148587931	0.000000000
1,377	0.0000124363	0.362572705	0.000004509
1,783	0.0000050520	1.000000000	0.000005839

Mean activity at risk height (hr-1) in wind farm 0.0034 (0.34%)

Vr = 423,987 m3, Vr/Vw = 0.0007207

Vw Occupancy = 26,602.6 s, Vr Occupancy =19.2 s

Transit time = 0.2759 s at 13.7 m/s, estimated number of transits = 69.5

Collision probability from SNH sheet 0.056

Collisions with no avoidance 3.89, Collisions with 98% avoidance 0.078, Collisions with 98% avoidance & downtime 0.066

25 year mortality = 1.65 or one death every 15.1 years.

Annex 7: Golden eagle

Flying time (s)	Flying time hahr	Weighted flying time hahr	
Risk height	Risk height	Weighting	Risk height
737	0.0000036227	0.484151775	0.000001754
33	0.0000005113	0.151787543	0.000000078
1,360	0.0000088950	0.364060682	0.000003238
2,129	0.0000043430	1.000000000	0.000005070

Mean activity at risk height (hr-1) in wind farm 0.00295 (0.295%)

Vr = 484,556 m3, Vr/Vw = 0.0008237

Vw Occupancy = 47,667.9 s, Vr Occupancy = 39.3 s

Transit time = 0.288 s at 15.0 m/s, estimated number of transits = 136.3

Collision probability from SNH sheet 0.084

Collisions with no avoidance 11.45, Collisions with 99% avoidance 0.115, Collisions with 99% avoidance and downtime 0.097

25 year mortality = 2.43 or one death every 10.3 years.

Annex 8: Hen harrier

Flying time (s)	Flying time hahr	Weighted flying time hahr	
Risk height	Risk height	Weighting	Risk height
768	0.0000037768	0.484151775	0.000001829
178	0.0000027921	0.151787543	0.000000424
770	0.0000050357	0.364060682	0.000001833
1,716	0.0000038682	1.000000000	0.000004086

Mean activity at risk height (hr-1) in wind farm 0.00238 (0.238%)

Vr = 446,420 m3, Vr/Vw = 0.0007589

Vw Occupancy = 38,413.9 s, Vr Occupancy = 29.2 s

Transit time = 0.3317 s at 12.0 m/s, estimated number of transits = 87.9

Collision probability from SNH sheet 0.069

Collisions with no avoidance 6.1, Collisions with 99% avoidance 0.061, Collisions with 99% avoidance downtime 0.052

25 year mortality = 1.29 or one death every 19.4 years.

Annex 9: Kestrel

Flying time (s)	Flying time hahr	Weighted flying time hahr	
Risk height	Risk height	Weighting	Risk height
893	0.0000043915	0.484151775	0.000002126
23	0.0000003608	0.151787543	0.000000055
1,656	0.0000108301	0.364060682	0.000003943
2,572	0.0000051941	1.000000000	0.000006124

Mean activity at risk height (hr-1) in wind farm 0.00357 (0.357%)

Vr = 431,839 m3, Vr/Vw = 0.0007341

Vw Occupancy = 55,576.1 s, Vr Occupancy = 42.3 s

Transit time = 0.3812 s at 10.1 m/s, estimated number of transits = 110.9

Collision probability from SNH sheet 0.066

Collisions with no avoidance 7.3, Collisions with 98% avoidance 0.146, Collisions with 98% avoidance & downtime 0.124

25 year mortality = 3.1 or one death every 8.0 years.

Appendix 3. Details of all target species records (VPs 1 & 3) with their height band records (every 15 seconds of the record, 0 – 360 s).

Flights at heights 2 & 3 are assumed to be at RSH. The table is split into records which potentially contributed to the collision calculations and those which did not. A flight within its VP viewshed and a 500 m turbine buffer could contribute to the collision calculations but only if part of the flight was at RSH. Note that the 15 s height band recording continued beyond 360 s but those columns have been removed for presentational purposes. If a record is curtailed the final height band has two following dots, e.g. 3.., indicating that the majority of subsequence records were in height band 3.

Date	VP	Species	N	secs	start	0	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360
2014-16 in CRA																														
21/11/14	1	EA	1	90	10:30	2	2	2	2	2	1	1																		
22/11/14	3	HH	1	360	15:40	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
23/11/14	3	EA	1	75	13:22	2	2	2	2	2	1																			
23/11/14	3	HH	1	180	14:35	1	1	1	1	2	2	2	2	2	2	2	2	2												
08/12/14	3	HH	1	420	14:07	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2..
08/12/14	3	PE	1	150	15:18	3	3	3	3	3	2	2	2	2	2	2														
09/12/14	3	EA	1	210	10:53	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2										
10/12/14	1	HH	1	165	11:14	1	1	1	1	1	1	1	2	2	2	2														
19/01/15	3	GP	10	45	12:28	2	2	2	1																					
19/01/15	3	EA	1	360	14:41	3	3	3	3	3	3	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1
22/01/15	1	WS	3	75	12:08	3	3	3	3	2	2																			
22/01/15	1	EA	2	300	12:53	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3				
22/01/15	1	HH	1	210	14:03	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1										
23/01/15	3	EA	1	330	10:22	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
09/02/15	1	HH	1	75	13:38	2	2	2	1	1	1																			
11/02/15	3	GP	7	75	10:45	2	2	2	2	2	2																			
05/03/15	3	EA	1	780	13:09	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
06/03/15	1	GP	28	45	12:47	3	3	3	2																					
09/03/15	3	EA	1	180	13:55	3	3	3	3	3	3	3	3	2	2	2	2	2												
09/03/15	3	EA	2	480	14:21	3	3	3	3	3	3	3	3	2	2	2	2	2	3	3	2	2	2	2	3	3	3	3	2	2..
09/03/15	3	EA	1	420	14:50	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3..
09/03/15	3	EA	1	300	14:52	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2				
06/04/15	3	WE	1	900	14:22	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3..
06/04/15	3	HH	1	360	14:39	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	1	1
06/04/15	3	EA	1	960	15:37	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2..
06/04/15	3	GI	1	420	16:10	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3..
07/04/15	1	GP	18	75	12:16	3	3	3	2	2	1																			
10/04/15	1	HH	1	360	10:51	1	1	1	1	1	1	1	2	2	3	2	3	2	3	2	3	2	1	2	1	2	1	2	1	2
10/04/15	1	HH	1	240	11:34	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	1	1								
10/04/15	1	HH	1	180	11:55	3	3	3	3	3	3	3	2	2	2	2	1	1												
10/04/15	1	HH	1	210	11:59	3	3	3	3	3	3	3	3	3	2	2	2	2	1	1										
10/04/15	1	HH	1	300	13:56	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2				
18/05/15	1	EA	1	180	11:23	2	2	2	2	2	2	2	2	2	2	2	1	1												
18/05/15	1	HH	1	135	12:27	2	2	2	2	2	2	2	2	2	2															

Date	VP	Species	N	secs	start	0	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360
18/05/15	1	HH	1	210	14:28	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3										
18/05/15	1	HH	1	130	15:17	2	2	2	2	2	2	1	1	1																
20/05/15	3	ML	1	165	10:16	2	2	2	1	2	1	1	1	2	2	1	1													
08/06/15	1	EA	1	600	14:49	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3..
09/06/15	3	HH	1	75	10:32	2	2	2	1	1	1																			
09/06/15	3	EA	1	1980	11:05	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1..
09/06/15	3	HH	1	240	10:54	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	2	2								
09/06/15	3	HH	1	240	11:13	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3								
10/06/15	1	HH	1	150	07:16	2	2	1	1	2	1	2	1	2	1	2														
13/07/15	1	HH	1	540	15:17	1	1	1	1	1	1	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2..
13/07/15	1	EA	1	480	17:02	2	2	2	2	2	2	2	1	1	1	1	2	2	3	3	3	3	3	3	3	3	3	3	3	3..
14/07/15	3	HY	1	150	09:28	2	2	1	1	1	1	1	1	1	1	1														
14/07/15	1	RH	2	30	19:22	2	2	2																						
14/07/15	1	HH	1	135	20:32	3	3	3	3	3	3	2	2	2	2															
15/07/15	3	HH	1	360	19:28	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	1	1	1	1	1	1	1	1
24/08/15	1	RH	2	75	06:38	2	2	2	2	2	2																			
24/08/15	1	PE	1	75	07:41	2	2	2	2	2	2																			
24/08/15	1	EA	1	660	08:00	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2								
24/08/15	1	HH	1	360	09:59	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1
27/08/15	3	HH	1	150	14:10	1	1	1	1	1	1	2	2	2	2	2														
03/09/15	1	OP	1	450	15:33	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2..
17/09/15	3	EA	1	720	12:21	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3..
26/10/15	1	HH	1	210	13:14	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2										
26/10/15	1	EA	1	300	16:50	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1				
26/10/15	1	ML	1	45	16:50	2	2	2	2																					
28/10/15	3	HH	1	150	12:57	2	2	2	2	2	2	2	2	2	1	1														
29/10/15	3	GJ	8	45	09:18	2	2	2	1																					
29/10/15	3	EA	1	480	12:04	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3..
09/11/15	1	HH	1	150	15:19	2	2	2	1	1	1	1	1	1	1	1														
10/11/15	1	GP	40	75	16:08	2	2	2	1	1	1																			
10/12/15	3	PE	1	150	14:10	3	3	3	3	2	2	2	1	1	1	1														
19/01/16	1	WS	2	75	11:02	2	2	2	2	2	2																			
19/01/16	1	HH	1	105	14:46	2	2	2	2	2	1	1	1																	
22/01/16	3	EA	1	210	09:33	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1										
22/01/16	3	EA	1	90	09:55	2	2	2	2	2	2	2																		
22/01/16	3	EA	1	360	10:32	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2..
22/01/16	3	PE	1	45	11:05	2	2	2	2																					
08/02/16	3	GP	3	30	10:50	2	2	2																						
08/02/16	3	GP	44	75	12:09	2	2	2	2	2	2																			
09/02/16	1	HH	1	120	12:52	1	1	1	1	1	2	2	2	2																
06/04/16	3	HH	1	120	13:45	2	2	2	2	1	1	1	1	1																
2018-19 in CRA																														
25/04/18	3	OP	1	393	07:59	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1..

Date	VP	Species	N	secs	start	0	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360
25/04/18	3	EA	1	83	11:15	2	2	2	2	1	1	1																		
25/04/18	3	EA	1	202	11:19	1	1	2	2	1	1	1	2	2	2	2	2	2	1	1										
25/04/18	3	EA	1	231	11:26	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2								
25/04/18	1	EA	1	290	14:21	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1				
25/04/18	1	EA	1	102	16:07	2	2	2	2	2	2	2	2																	
25/04/18	1	HH	1	53	17:04	1	2	2	1	1																				
30/05/18	1	RH	1	54	06:25	3	3	3	3	2																				
30/05/18	3	EA	1	884	12:48	1	1	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3..
30/05/18	3	HH	1	46	13:34	1	1	1	1	1																				
26/06/18	1	HH	1	72	16:52	2	2	2	2	2	2																			
25/07/18	3	HH	1	58	06:56	1	1	1	1	1																				
25/07/18	3	HH	1	22	07:05	1	1	1																						
25/07/18	3	SN	4	24	08:48	2	2	2																						
25/07/18	1	EA	1	520	13:40	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3..
24/08/18	3	OP	3	634	10:28	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3..
25/08/18	1	HH	1	265	13:32	1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3						
22/01/19	1	WS	2	38	13:45	2	2	2																						
22/01/19	3	GP	24	702	11:23	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2..
22/01/19	3	GP	24	237	11:31	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3								
22/01/19	3	GP	24	88	11:36	2	2	2	2	2	2																			
22/01/19	3	GP	24	187	11:39	2	2	2	2	2	2	2	2																	
22/01/19	3	GP	24	400	11:47	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	3	3	3..
22/01/19	3	HH	1	300	12:20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				
23/01/19	3	SN	1	41	12:10	3	3	3	3																					
23/01/19	3	HH	1	227	13:16	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1									
05/02/19	1	EA	1	318	11:22	2	2	2	2	2	2	2	3	3	2	2	2	2	2	2	2	2	2	2	2	2	1			
06/02/19	1	HH	1	82	09:01	1	1	1	1	1	1	1																		
06/02/19	1	EA	1	222	09:39	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1									
06/02/19	3	EA	1	173	11:31	1	1	1	1	1	1	1	1	1	1	1	1													
06/02/19	3	HH	1	353	12:28	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
06/02/19	3	HH	1	204	12:40	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
06/03/19	3	GP	17	169	10:41	2	2	2	2	2	2	2	2																	
06/03/19	3	HH	1	243	14:02	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1								
06/03/19	3	HH	1	72	14:07	1	1	1	1	1	1																			
06/03/19	3	HH	1	145	14:09	1	1	1	1	1	1	1	1	1	1	1														
06/03/19	3	HH	1	1020	14:22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1..
07/03/19	1	EA	2	170	09:58	2	2	2	2	2	2	2	2	2	2	2	2													
07/03/19	1	EA	1	282	10:03	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3					
07/03/19	1	EA	2	1009	10:15	2	2	2	2	2	2	2	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1..
07/03/19	3	HH	1	5	11:02	1	1																							
07/03/19	3	HH	1	429	11:59	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1..
07/03/19	3	HH	1	343	12:22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
07/03/19	3	HH	1	650	12:35	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1..
07/03/19	3	EA	1	800	13:07	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2..

Date	VP	Species	N	secs	start	0	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360
2020 in CRA																														
13/03/20	1	EA	2	344	10:19	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2		
13/03/20	1	EA	2	79	11:01	3	3	3	3	2	2																			
27/04/20	1	HH	1	376	12:55	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	1
30/05/20	1	EA	1	160	06:44	3	3	3	3	3	3	3	3	3	3	3	2													
30/05/20	1	EA	1	235	07:03	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	2	1								
30/05/20	1	HH	1	182	08:52	4	4	4	4	4	4	4	4	4	4	4	3	3												
30/05/20	1	EA	2	424	10:25	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4..
05/08/20	1	EA	1	47	11:32	3	3	3	2																					
2021 in CRA																														
30/03/21	1	EA	1	45	10:49	3	3	2	1																					
31/03/21	3	PG	2	58	11:29	4	4	4	4	4																				
31/03/21	3	HH	1	40	14:59	1	1	1	1																					
21/04/21	1	OP	1	1224	12:54	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	1	1	1	2...
21/04/21	1	WE	1	283	16:10	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4					
21/04/21	1	OP	1	312	17:15	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4			
21/04/21	1	OP	1	15	17:21	1	1																							
22/04/21	3	WE	2	545	11:40	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4..
12/05/21	1	CG	2	145	15:02	3	3	3	3	3	3	3	2	2	2	2														
26/07/21	3	HH	1	68	15:38	2	2	2	2	2																				
28/07/21	1	HH	1	177	10:40	3	3	3	3	4	4	4	4	4	3	2	1													
2014-16 not in CRA																														
22/11/14	3	EA	1	165	11:26	3	3	3	3	3	3	3	2	2	2	2	2													
22/11/14	3	HH	1	210	13:33	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
22/11/14	3	EA	1	240	15:14	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	1	1								
22/11/14	3	NW	33	75	16:32	2	2	2	2	2	2																			
22/11/14	3	NW	50	60	16:35	2	2	1	1	1																				
23/11/14	3	EA	1	210	13:45	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2										
06/12/14	1	HH	1	105	11:15	1	1	1	1	1	1	1	1																	
08/12/14	3	HH	1	360	12:26	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
08/12/14	3	EA	1	90	12:59	2	2	2	2	2	2	2																		
08/12/14	3	EA	1	330	12:59	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	2	2		
08/12/14	3	HH	1	210	15:35	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
09/12/14	3	EA	1	120	10:53	0	0	0	0	0	0	0	0	0																
09/12/14	3	HH	1	180	11:13	1	1	1	1	1	1	1	1	1	1	1	1	1												
09/12/14	1	HH	1	180	13:08	1	1	1	1	1	1	1	1	1	1	1	1	1												
10/12/14	1	HH	1	75	13:23	1	1	1	1	1	1																			
19/01/15	3	HH	1	330	11:05	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
21/01/15	3	EA	1	640	13:23	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3..
21/01/15	3	HH	1	270	15:08	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
21/01/15	3	HH	1	150	15:17	1	1	1	1	1	1	1	1	1	1	1														
22/01/15	1	GP	9	120	10:10	2	2	2	2	2	2	2	2	2																
22/01/15	1	EA	2	420	11:44	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3..

Date	VP	Species	N	secs	start	0	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360
22/01/15	1	EA	1	180	12:59	2	2	2	2	2	2	2	2	2	1	1	1	1												
10/02/15	1	GP	4	30	15:48	2	2	2																						
10/02/15	1	GP	23	60	16:13	2	2	2	2	1																				
10/02/15	1	NW	50	75	17:58	1	1	2	2	1	1																			
05/03/15	3	BK	2	30	13:09	1	1	1																						
11/03/15	1	GP	40	45	08:01	2	2	2	1																					
06/04/15	3	EA	1	15	15:16	1	1																							
08/04/15	3	HH	1	300	07:19	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				
08/04/15	3	HH	1	240	08:45	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1								
08/04/15	3	HH	1	210	08:54	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
08/04/15	3	HH	1	120	09:19	1	1	1	1	1	1	1	1	1																
10/04/15	1	HH	2	45	11:16	1	1	1	1																					
19/05/15	1	HH	1	90	06:40	1	1	1	1	1	1																			
19/05/15	1	HH	1	60	06:43	1	1	1	1																					
20/05/15	3	EA	1	210	10:43	2	2	2	2	3	3	3	3	3	3	2	2	2	1	1										
08/06/15	1	RH	1	75	14:36	3	3	3	2	2	2																			
08/06/15	1	HH	1	150	16:54	1	1	1	1	1	1	1	1	1	1	1														
08/06/15	1	HH	1	45	19:10	2	2	1	1																					
09/06/15	3	HH	1	180	07:24	1	1	1	1	1	1	1	1	1	1	1	1	1												
09/06/15	3	CU	1	45	09:10	1	1	1	1																					
09/06/15	3	EA	1	540	10:54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0..
09/06/15	3	CU	1	180	10:54	1	1	1	1	1	1	1	1	1	1	1	1	1												
10/06/15	1	HH	1	75	07:35	2	2	1	1	1	1																			
11/06/15	3	CU	1	45	16:10	1	1	1	1																					
11/06/15	3	HH	1	210	18:42	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
13/07/15	1	HH	1	60	07:32	1	1	1	1	1																				
13/07/15	1	HH	1	180	14:58	1	1	1	1	1	1	1	1	1	1	1	1	1												
14/07/15	3	RH	2	90	09:58	3	3	3	3	3	3	3																		
14/07/15	3	HH	1	180	11:14	1	1	1	1	1	1	1	1	1	1	1	1	1												
14/07/15	3	HH	1	105	11:46	2	2	2	1	1	1	1	1																	
14/07/15	3	HH	1	75	13:05	1	1	1	1	1	1																			
14/07/15	3	HH	1	210	13:42	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2										
14/07/15	3	RH	2	45	14:51	3	3	3	3																					
14/07/15	1	HH	1	150	20:03	1	1	1	1	1	1	1	1	1	1	1														
15/07/15	3	HH	1	480	19:40	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3..
24/08/15	1	RH	1	60	06:43	3	3	3	3	3																				
24/08/15	1	EA	1	660	08:00	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3..
24/08/15	1	HH	1	150	11:55	1	1	1	1	1	1	1	1	1	1	1														
25/08/15	3	HH	1	210	10:30	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
25/08/15	3	RH	1	75	12:07	3	3	3	3	3	3																			
27/08/15	3	EA	1	210	16:22	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2										
17/09/15	3	EA	1	30	13:12	1	1	1																						
17/09/15	3	EA	1	15	13:21	1	1																							
17/09/15	3	HH	1	720	15:57	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1..

Date	VP	Species	N	secs	start	0	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360
17/09/15	3	HH	1	480	16:48	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1..
18/09/15	3	BK	1	30	08:45	1	1	1																						
26/10/15	1	EA	1	240	13:50	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2								
26/10/15	1	HH	1	240	15:20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1								
26/10/15	1	ML	1	30	16:48	1	1	1																						
27/10/15	1	WS	1	180	08:29	3	3	3	3	3	3	3	3	3	3	3	3	3												
28/10/15	3	HH	1	240	14:33	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1								
28/10/15	3	HH	1	420	14:39	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1..
29/10/15	3	HH	1	240	13:35	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1								
09/11/15	1	HH	1	180	15:10	1	1	1	1	1	1	1	1	1	1	1	1	1												
10/11/15	1	NW	9	30	17:04	2	2	2																						
12/11/15	3	EA	1	360	11:09	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2
12/11/15	3	EA	1	150	11:20	3	3	3	3	3	3	3	2	2	2	2														
12/11/15	3	HH	1	420	11:45	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1..
13/11/15	3	HH	1	150	12:00	1	1	1	1	1	1	1	1	1	1	1														
07/12/15	1	HH	1	90	15:02	1	1	1	1	1	1	1																		
10/12/15	3	HH	1	240	12:45	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1								
11/12/15	3	HH	1	240	11:50	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1								
19/01/16	1	HH	1	90	16:10	1	1	1	1	1	1	1																		
19/01/16	1	NW	60	45	17:12	2	2	2	2																					
22/01/16	3	HH	1	180	10:56	1	1	1	1	1	1	1	1	1	1	1	1	1												
08/02/16	3	BK	1	15	10:14	1	1																							
09/02/16	1	GP	4	30	14:40	2	2	2																						
11/02/16	3	EA	1	720	13:31	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3..
09/03/16	3	HH	1	180	16:25	1	1	1	1	1	1	1	1	1	1	1	1	1												
10/03/16	1	EA	1	720	12:30	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3..
17/03/16	3	HH	1	300	12:47	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				
04/04/16	1	RH	2	45	14:37	3	3	3	2																					
04/04/16	1	HH	1	120	16:05	1	1	1	1	1	1	1	1	1																
05/04/16	3	HH	1	720	08:02	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1..
06/04/16	3	HH	1	210	13:52	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
23/05/16	1	HH	1	210	16:09	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
23/05/16	1	HH	1	540	17:17	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2..
23/05/16	1	RH	2	75	19:10	3	3	3	3	3	3																			
24/05/16	1	OP	1	105	09:16	2	2	2	2	2	2	2	2																	
30/05/16	3	EA	1	360	07:46	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
30/05/16	3	RH	2	75	09:10	3	3	3	3	3	3																			
14/06/16	1	CU	1	30	16:14	2	2	2																						
14/06/16	3	RH	2	45	19:55	3	3	3	3																					
14/06/16	3	CU	1	30	20:18	2	2	2																						
15/06/16	1	RH	2	75	08:17	3	3	3	3	3	3																			
15/06/16	1	RH	2	45	10:40	2	2	2	2																					
15/06/16	1	RH	1	150	12:29	2	2	2	2	3	3	3	3	3	3	3														
16/06/16	3	CU	2	45	05:02	2	2	2	2																					

Date	VP	Species	N	secs	start	0	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360
16/06/16	3	RH	2	30	06:41	2	2	2																						
19/07/16	3	EA	1	210	09:01	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3										
20/07/16	1	CU	1	30	15:39	2	2	2																						
2018-19 not in CRA																														
25/04/18	3	CU	1	89	08:25	2	2	2	1	1	1	1																		
25/04/18	3	HH	1	106	10:16	2	2	2	2	2	2	2	1	1																
25/04/18	3	HH	1	50	10:53	2	2	2	2	2																				
25/04/18	1	HH	1	35	13:22	2	2	1																						
25/04/18	1	HH	1	8	14:10	1	1																							
25/04/18	1	HH	2	45	14:23	2	2	2	2																					
25/04/18	1	HH	1	18	16:24	1	1																							
25/04/18	1	HH	1	40	16:43	1	1	1	1																					
30/05/18	1	HH	1	575	09:57	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3..
30/05/18	3	EA	1	257	15:54	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3							
30/05/18	3	HH	1	205	16:09	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1										
26/06/18	1	CU	1	23	17:00	2	2	1																						
25/07/18	3	EA	1	74	09:09	2	2	2	2	2	2																			
25/07/18	3	EA	1	367	10:59	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2..
25/07/18	3	EA	1	138	11:38	2	2	2	2	2	2	2	2	2	2	2														
25/07/18	1	HH	1	23	14:17	1	1	1																						
25/08/18	1	HH	1	24	12:17	2	2	2																						
18/09/18	3	RG	1	5	09:26	1																								
18/09/18	3	ML	1	10	10:01	1																								
18/09/18	1	EA	1	457	14:11	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3..
18/09/18	1	EA	1	72	15:25	3	3	3	3	3	3																			
19/09/18	3	HH	1	298	11:51	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1		
21/11/18	3	EA	1	25	11:57	1	1	1																						
11/12/18	3	RG	1	13	10:49	1																								
22/01/19	3	HH	1	78	13:38	1	1	1	1	1																				
23/01/19	3	GP	5	22	14:25	3	3	3																						
06/02/19	3	EA	1	55	10:42	2	2	1	1	1																				
06/02/19	3	SN	1	15	11:32	1	1																							
06/03/19	1	GP	1	43	15:49	2	2	2	2																					
06/03/19	1	GP	2	10	16:02	2	2																							
07/03/19	1	EA	1	234	09:20	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2								
07/03/19	3	HH	1	83	11:08	1	1	1	1	1	1	1																		
07/03/19	3	EA	1	257	13:15	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3								
2020 not in CRA																														
27/04/20	1	EA	1	188	12:37	4	4	4	4	4	4	4	4	4	4	4	4	4												
27/04/20	1	HH	1	190	13:47	3	3	3	3	3	3	3	3	3	3	3	3	3	3											
27/04/20	1	EA	1	302	14:15	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3	2	1				
27/04/20	1	HH	1	43	16:23	2	2	2	1																					
27/04/20	1	HH	1	10	16:37	1	1																							
31/05/20	3	EA	2	437	11:34	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4..

Date	VP	Species	N	secs	start	0	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360
2021 not in CRA																														
22/04/21	3	BK	3	10	11:48	1	1																							
22/04/21	3	BK	2	10	13:05	1	1																							
12/05/21	1	RH	1	102	11:53	4	4	4	4	4	4	4	4																	
12/05/21	1	RH	1	117	12:19	4	4	4	4	4	4	4	4	4																
16/08/21	1	RH	1	46	16:26	4	4	4	4																					
22/04/21	3	BK	3	10	11:48	1	1																							

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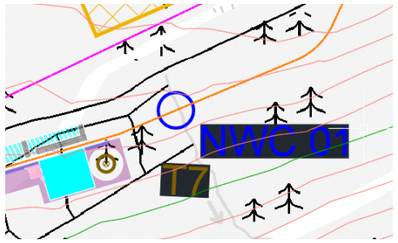
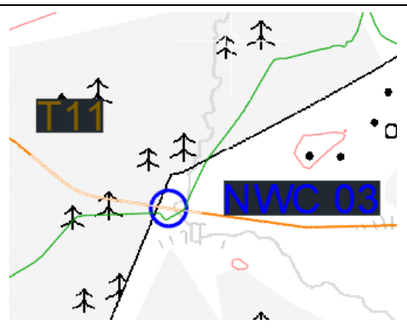
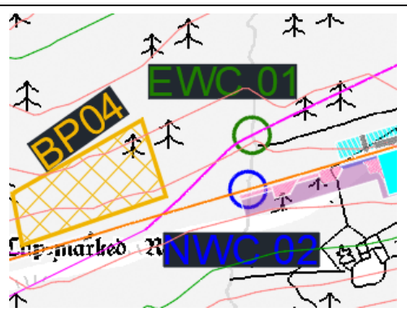
Appendix 11.1: Watercourse Crossing Strategy

Appendix 11.1 Watercourse Crossing Strategy

Crossing Structure No.	NGR	Map Location	Channel Width (m)	Photograph	Crossing Proposed	Description	CAR Authorisation	Additional Mitigation / Comments
New Watercourse Crossing (NWC) 01	NR 72476 42295		0.45m		Closed Pipe Culvert	The proposed access road will cross an unnamed tributary of the Clachaig Water. The watercourse is approximately 0.45m wide. The watercourse was heavily overgrown; thus, it was difficult to identify the condition upstream and downstream. It is assumed the channel width remains reasonably constant. 500mm pipe proposed. Due to the width of the watercourse a close pipe culvert is proposed.	Registration	Good practice guidance to be adhered to. Appropriate drainage, filtration and settlement control will be required to protect the watercourse against increased runoff of suspended solids.
NWC 02	NR 72252 42224		0.45m		Closed Pipe Culvert	The proposed access road will cross an unnamed tributary of the Clachaig Water. The watercourse is approximately 0.45m wide. The watercourse was heavily overgrown; thus, it was difficult to identify the condition upstream and downstream. It is assumed that the upstream and downstream channel width remains constant. Watercourse was dry at time of visit but likely that in the winter the watercourse would be wet. 500mm pipe proposed. Due to the width of the watercourse a close pipe culvert is proposed. Please note, the crane pad seen in this image, crossing the watercourse, is not an area of hardstanding, it is an area of ground that will be levelled.	Registration	Good practice guidance to be adhered to. Appropriate drainage, filtration and settlement control will be required to protect the watercourse against increased runoff of suspended solids.
NWC 03	NR 71584 41386		0.5m		Closed Pipe Culvert	The proposed access road will cross an unnamed tributary of the Clachaig Water. The watercourse is approximately 0.5m wide and the channel width remains consistent upstream and downstream. 650mm pipe proposed. Due to the width of the watercourse a close pipe culvert is proposed.	Registration	Good practice guidance to be adhered to. Appropriate drainage, filtration and settlement control will be required to protect the watercourse against increased runoff of suspended solids.

NWC 04	NR 72114 41416		0.5m		Closed Pipe Culvert	The proposed access road will cross an unnamed tributary of the Clachaig Water. The watercourse is approximately 0.5m wide and the channel width remains consistent upstream and downstream. 650mm pipe proposed. Due to the width of the watercourse, a close pipe culvert is proposed.	Registration	Good practice guidance to be adhered to. Appropriate drainage, filtration and settlement control will be required to protect the watercourse against increased runoff of suspended solids.
Existing Watercourse Crossing (EWC) 01	NR 72255 42269		1.5m	Upstream   Downstream 	Closed Pipe Culvert	The existing access track will be used, where there is an existing closed pipe culvert of approx. 1.3m diameter. This is currently located on an unnamed tributary of Clachaig Water. Upstream and downstream the channel width remains reasonably constant. There is a small pooling of water at the outlet of approx. 3m wide and 4m in width. At the inlet, the invert level is on the bed of the watercourse and at the outlet it is about 0.6m above the bed. If there is a requirement to replace the culvert, the design of the new culvert will be such that existing hydrological conditions are maintained and it complies with SEPA guidance.	Registration (if replacement required)	Good practice guidance to be adhered to. Appropriate drainage, filtration and settlement control will be required to protect the watercourse against increased runoff of suspended solids.

EWC 02	NR 71261 41554		6.0m	Upstream   Downstream 	Single Span Bridge	The existing access road will be used where an existing single span bridge exists (span approx. 9m). The watercourse channel is approx. 6m wide. Upstream and downstream the channel width remains reasonably constant. Should there be a requirement to replace the single span bridge to accommodate turbine deliveries, it is recommended to replace in a 'like for like' manner in order to maintain the existing hydrological conditions (i.e. replace with another single span bridge).	Registration (if replacement required)	Good practice guidance to be adhered to. Appropriate drainage, filtration and settlement control will be required to protect the watercourse against increased runoff of suspended solids.

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Appendix 11.2: Ground Water Dependent Terrestrial Ecosystems Assessment

Appendix 11.2 Ground Water Dependent Terrestrial Ecosystems Assessment (GWDTE Assessment)

1.1.1 The following should be noted with when reviewing the assessment in Table 1:

- Column “ID” makes reference to areas shown on Figure 11.2.1 (EIAR Volume 3),
- Column “Habitat Type” is based on the NVC survey as detailed in Chapter 9: Ecology (EIAR Volume 2a),
- Column “Dependency Classification” is based on the Scottish Environment Protection Agency’s (SEPA’s) *Land Use Planning System, Guidance Note 4, Planning Guidance on Onshore Windfarm Developments*, and
- Turbine and small temporary quarries (borrow pits (BP)) numbers are shown on Figure 11.2.1 (EIAR Volume 3) and are described in Chapter 3: Project Description (EIAR Volume 2a).

Table 1. GWDTE Assessment

ID	Location (NGR)	Habitat Type (NVC Identification)	Area (m²)	Land Take (m²)	Dependency Classification	Distance to New Infrastructure: Access Tracks and Shallow Excavations	Distance to New Infrastructure: Turbine (Turbine No) / Borrow Pits (BP)	Orientation to New Wind Farm Infrastructure	Underlying Geology and Groundwater Productivity	Conclusion
1	NR 71966 43276	M6, M10	101,281	High	0m	0m (T1, BP06)	Area located in the northern central area of the Development Site. Turbine T1 is located within the habitat and turbine T3 is located within the 250m exclusion zone advised by SEPA. Borrow pit BP06 is located within the 250m exclusion zone advised by SEPA. A small section of the access track that services turbine T1 and BP06 is located within the habitat. A section of access track that runs between turbine T1 and T3 is within the 100m exclusion zone advised by SEPA.	Drift: Glacial Till / Unmapped / Bedrock at or near surface Solid: Metasedimentary Rocks – Green Beds Formation / Glen Sluan Schist Low Productivity	All formations which underlie this area are classed as low productivity aquifers in which flow is virtually all through fractures and other discontinues. Peat probing has found deeper peaty soils in the area which range up to 1.50m, with isolated areas of deeper peat up to 4.0m in depth. Parts of the habitats in this area are also confined to the banks of watercourses. Due to the relatively impermeable nature of the solid geology and the presence of peaty soils it is anticipated the habitats in the area will be fed by perched groundwater held within the peat. Therefore, it is anticipated that the dependency on groundwater of this habitat is **LOW**.
2	NR 71049 42844	M15	25,874	Moderate	>100m	>250m All Turbines and Small Temporary Quarries	Area located in the north west of the Development Site. No wind turbines or small temporary quarries are located within the 250m exclusion zone advised by SEPA. No new access tracks or hardstanding areas are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary Rocks – Loch Tay Limestone / Stonefield Schist and Metaigneous Rocks: Amphibolite Low Productivity	No further assessment required due to new infrastructure and turbines being located outside of SEPA advised exclusion zones.

ID	Location (NGR)	Habitat Type (NVC Identification)	Area (m²)	Land Take (m²)	Dependency Classification	Distance to New Infrastructure: Access Tracks and Shallow Excavations	Distance to New Infrastructure: Turbine (Turbine No) Borrow Pits (BP)	Orientation to New Wind Farm Infrastructure	Underlying Geology and Groundwater Productivity	Conclusion
3	NR 70659 41647	M15	69,066		Moderate	0m	0m (T8, T10)	Long linear habitats located on the banks of Clachaig Water as well as unnamed tributaries located within the central area of the Development Site. Turbine T8 and T10 are located within the 250m exclusion zone advised by SEPA. Proposed new access tracks to access the above turbines are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary Rocks – Glen Sluan Schist / Loch Tay Limestone / Stonefield Schist Low Productivity	All formations which underlie this area are classes as low productivity aquifers in which flow is virtually all through fractures and other discontinues. Peat probing has found peaty soils in the area which range up to 0.5m in depth. The habitats in this area are also generally all confined to the banks of watercourses. Due to the relatively impermeable nature of the solid geology and the presence of peaty soils, it is anticipated that the habitats in the area will be fed by perched groundwater held within the peat. Therefore, it is anticipated that the dependency on groundwater of this habitat is **LOW**.
4	NR 71038 41979	W4	42,846		High	0m	0m (T3, T4, T8, T10)	Long linear habitats located on the banks of Clachaig Water as well as unnamed tributaries located within the central area of the Development Site. Turbines T3, T4, T8 and T10 are located within the 250m exclusion zone advised by SEPA. Proposed new access tracks to access the above turbines are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary Rocks – Glen Sluan Schist / Loch Tay Limestone / Stonefield Schist Low Productivity	All formations which underlie this area are classed as low productivity aquifers in which flow is virtually all through fractures and other discontinues. Peat probing has found peaty soils in the area which range up to 1.0m in depth. The habitats in this area are also generally all confined to the banks of watercourses. Due to the relatively impermeable nature of the solid geology and the presence of peaty soils it is anticipated the habitats in the area will be fed by perched groundwater held within the peat and surface water running into the watercourse. Therefore, it is anticipated that the dependency on groundwater of this habitat is **LOW**.
5	NR 70745 41443	M15	6,704		Moderate	>100m	>250m All Turbines and Small Temporary Quarries	Area located in the west of the Development Site. No wind turbines or small temporary quarries are located within the 250m exclusion zone advised by SEPA. No new access tracks or hardstanding areas are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary Rocks – Loch Tay Limestone / Stonefield Schist Metaigneous Rocks: Amphibolite Low Productivity	No further assessment required due to new infrastructure and turbines being located outside of SEPA advised exclusion zones.

ID	Location (NGR)	Habitat Type (NVC Identification)	Area (m²)	Land Take (m²)	Dependency Classification	Distance to New Infrastructure: Access Tracks and Shallow Excavations	Distance to New Infrastructure: Turbine (Turbine No) Borrow Pits (BP)	Orientation to New Wind Farm Infrastructure	Underlying Geology and Groundwater Productivity	Conclusion
6	NR 70381 41187	M15, M23	24,637		High	>100m	>250m All Turbines and Small Temporary Quarries	Area located in the west of the Development site. No wind turbines or small temporary quarries are located within the 250m exclusion zone advised by SEPA. No new access tracks or hardstanding areas are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary Rocks – Loch Tay Limestone / Stonefield Schist Metaigneous Rocks: Amphibolite Low Productivity	No further assessment required due to new infrastructure and turbines being located outside of SEPA advised exclusion zones.
7	NR 71763 40885	M6, M10	17,774		Moderate	0m	>250m All Turbines 0m (BP05)	Area located in the southern area of the Development Site. No wind turbines are located within the 250m exclusion zone advised by SEPA. BP05 is located within the 250m exclusion zone advised by SEPA. Proposed new access track to BP06 is located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metaigneous Rocks: Amphibolite Low Productivity	All formations which underlie this area are classed as low productivity aquifers in which flow is virtually all through fractures and other discontinues. Peat probing has generally found peaty soils in the area which range up to 2.0m in depth. Some of the habitats in this area are also confined to the banks of watercourses. Due to the relatively impermeable nature of the solid geology and the presence of peaty soils it is anticipated the habitats in the area will be fed by perched groundwater held within the peat and surface water running into the watercourse. Therefore, it is anticipated that the dependency on groundwater of this habitat is **LOW**.
8	NR 73165 40765	M15	371,977		Moderate	>100m	>250m All Turbines and Small Temporary Quarries	Area located in the south and south east of the Development Site. No wind turbines or small temporary quarries are located within the 250m exclusion zone advised by SEPA. No new access tracks or hardstanding areas are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary Rocks – Beinn Bheula Schist Formation / Green Beds Formation Low Productivity	No further assessment required due to new infrastructure and turbines being located outside of SEPA advised exclusion zones.

ID	Location (NGR)	Habitat Type (NVC Identification)	Area (m²)	Land Take (m²)	Dependency Classification	Distance to New Infrastructure: Access Tracks and Shallow Excavations	Distance to New Infrastructure: Turbine (Turbine No) Borrow Pits (BP)	Orientation to New Wind Farm Infrastructure	Underlying Geology and Groundwater Productivity	Conclusion
9	NR 73152 40962	M6	11,051		High	>100m	>250m All Turbines and Small Temporary Quarries	Area located in the south and south east of the Development Site. No wind turbines or small temporary quarries are located within the 250m exclusion zone advised by SEPA. No new access tracks or hardstanding areas are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary Rocks – Beinn Bheula Schist Formation / Green Beds Formation Low Productivity	No further assessment required due to new infrastructure and turbines being located outside of SEPA advised exclusion zones.
10	NR 72997 41623	M15	82,929		Moderate	>100m	>250m All Turbines and Small Temporary Quarries	Area located in the east of the Development Site. No wind turbines or small temporary quarries are located within the 250m exclusion zone advised by SEPA. No new access tracks or hardstanding areas are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metaigneous Rocks – Amphibolite Igneous Rocks – Olivine-dolerite, and analcite-olivine-dolerite Low Productivity	No further assessment required due to new infrastructure and turbines being located outside of SEPA advised exclusion zones.
11	NR 73788 41956	M15	216		Moderate	>100m	>250m All Turbines and Small Temporary Quarries	Area located in the east of the Development Site. No wind turbines or small temporary quarries are located within the 250m exclusion zone advised by SEPA. No new access tracks or hardstanding areas are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Igneous Rocks – Olivine-dolerite, and analcite-olivine-dolerite Probable Metavolcanic Rocks – Beinn Bheula Schist Low Productivity	No further assessment required due to new infrastructure and turbines being located outside of SEPA advised exclusion zones.
12	NR 74061 43046	M15	27,249		Moderate	>100m	>250m All Turbines and Small Temporary Quarries	Area located in the north east of the Development Site. No wind turbines or small temporary quarries are located within the 250m exclusion zone advised by SEPA. No new access tracks or hardstanding areas are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary Rocks – Beinn Bheula Schist Formation Low Productivity	No further assessment required due to new infrastructure and turbines being located outside of SEPA advised exclusion zones.

ID	Location (NGR)	Habitat Type (NVC Identification)	Area (m²)	Land Take (m²)	Dependency Classification	Distance to New Infrastructure: Access Tracks and Shallow Excavations	Distance to New Infrastructure: Turbine (Turbine No) Borrow Pits (BP)	Orientation to New Wind Farm Infrastructure	Underlying Geology and Groundwater Productivity	Conclusion
13	NR 74020 42921	M6, M15	24,596		High	>100m	>250m All Turbines and Small Temporary Quarries	Area located in the north east of the Development Site. No wind turbines or small temporary quarries are located within the 250m exclusion zone advised by SEPA. No new access tracks or hardstanding areas are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary Rocks – Beinn Bheula Schist Formation Low Productivity	No further assessment required due to new infrastructure and turbines being located outside of SEPA advised exclusion zones.
14	NR 73651 43104	M15	33,452		Moderate	>100m	>250m All Turbines and Small Temporary Quarries	Area located in the north east of the Development Site. No wind turbines or small temporary quarries are located within the 250m exclusion zone advised by SEPA. No new access tracks or hardstanding areas are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary – Green Beds Formation Igneous Rocks – Olivine-dolerite, and analcite-olivine-dolerite Low Productivity	No further assessment required due to new infrastructure and turbines being located outside of SEPA advised exclusion zones.
15	NR 73596 43174	M15, M6	25,206		High	0m	>250m All Turbines and Small Temporary Quarries	Area located in the north of the Development Site. No wind turbines or small temporary quarries are located within the 250m exclusion zone advised by SEPA. Proposed new access track entering the Proposed Development site to all turbines is located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary – Green Beds Formation Igneous Rocks – Olivine-dolerite, and analcite-olivine-dolerite Low Productivity	All formations which underlie this area are classed as low productivity aquifers in which flow is virtually all through fractures and other discontinues. Peat probing has found peaty soils in the area which range up to 1.5m in depth. The habitats in this area are also generally all confined to the banks of watercourses. Due to the relatively impermeable nature of the solid geology and the presence of peaty soils it is anticipated the habitats in the area will be fed by perched groundwater held within the peat and surface water running into the watercourse. Therefore, it is anticipated that the dependency on groundwater of this habitat is **LOW**.

ID	Location (NGR)	Habitat Type (NVC Identification)	Area (m²)	Land Take (m²)	Dependency Classification	Distance to New Infrastructure Access Tracks and Shallow Excavations	Turbine (Turbine No) Borrow Pits (BP)	Orientation to New Wind Farm Infrastructure	Underlying Geology and Groundwater Productivity	Conclusion
16	NR 73265 42553	M15	8,991		Moderate	>100m	>250m All Turbines and Small Temporary Quarries	Area located in the north of the Development Site. No wind turbines or small temporary quarries are located within the 250m exclusion zone advised by SEPA. No new access tracks or hardstanding areas are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary – Green Beds Formation Low Productivity	No further assessment required due to new infrastructure and turbines being located outside of SEPA advised exclusion zones.
17	NR73320 42330	M15, M6	65,151		High	>100m	>250m All Turbines and Small Temporary Quarries	Area located in the centre of the Development Site. No wind turbines or small temporary quarries are located within the 250m exclusion zone advised by SEPA. No new access tracks or hardstanding areas are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary – Green Beds Formation Igneous Rocks – Olivine-dolerite, and analcite-olivine-dolerite Low Productivity	No further assessment required due to new infrastructure and turbines being located outside of SEPA advised exclusion zones.
18	NR 72436 42024	M15	58,971		Moderate	0m	0m (T5, T7, T13, BP02 and BP03)	Area located in the centre of the Development Site. Turbines T5, T7 and T13 are all located within the 250m exclusion zone advised by SEPA. Borrow pits BP02 and BP03 are all located within the 250m exclusion zone advised by SEPA. Proposed new access tracks to access BP03 and T13 are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Igneous Rocks – Olivine-dolerite, and analcite-olivine-dolerite Metaigneous Rocks – Amphibolite Formation Low Productivity	All formations which underlie this area are classed as low productivity aquifers in which flow is virtually all through fractures and other discontinues. Peat probing has found peaty soils in the area which range up to 1.0m in depth. The habitats in this area are also generally all confined to the banks of watercourses. Due to the relatively impermeable nature of the solid geology and the presence of peaty soils it is anticipated the habitats in the area will be fed by perched groundwater held within the peat and surface water running into the watercourse. Therefore, it is anticipated that the dependency on groundwater of this habitat is **LOW**.

ID	Location (NGR)	Habitat Type (NVC Identification)	Area (m²)	Land Take (m²)	Dependency Classification	Distance to New Infrastructure: Access Tracks and Shallow Excavations	Distance to New Infrastructure: Turbine (Turbine No) Borrow Pits (BP)	Orientation to New Wind Farm Infrastructure	Underlying Geology and Groundwater Productivity	Conclusion
19	NR 72400 41949	W4, M23, M6	81,876		High	>100m	0m (T7, T13, BP03)	Area located in the centre of the Development Site. Turbines T7 and T13 are all located within the 250m exclusion zone advised by SEPA. Borrow pit BP03 is located within the 250m exclusion zone advised by SEPA. No new access tracks or hardstanding areas are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary – Green Beds Formation Metaigneous – Amphibolite Formation Low Productivity	All formations which underlie this area are classed as low productivity aquifers in which flow is virtually all through fractures and other discontinues. Peat probing has generally found peaty soils in the area which range up to 1.50m in depth with isolated deeper deposits up to 5.0m. The habitats in this area are also generally all confined to the banks of watercourses. Due to the relatively impermeable nature of the solid geology and the presence of peaty soils it is anticipated the habitats in the area will be fed by perched groundwater held within the peat and surface water running into the watercourse. Therefore, it is anticipated that the dependency on groundwater of this habitat is **LOW**.
20	NR 72263 42145	M15	5,208		Moderate	0m	0m (T7, BP04, BP03)	Area located in the centre of the Development Site. Turbine T7 is located within the 250m exclusion zone advised by SEPA. Borrow pits BP03 and BP04 is located within the 250m exclusion zone advised by SEPA. Proposed new access tracks from T7, to BP04 and from BP03 are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary – Green Beds Formation Low Productivity	All formations which underlie this area are classed as low productivity aquifers in which flow is virtually all through fractures and other discontinues. Peat probing has found peaty soils in the area which range up to 0.5m in depth. Due to the relatively impermeable nature of the solid geology and the presence of peaty soils it is anticipated the habitats in the area will be fed by perched groundwater held within the peat and surface water running into the watercourse. Therefore, it is anticipated that the dependency on groundwater of this habitat is **LOW**.
21	NR 72295 42344	M6	17,722		High	0m	0m (T7, BP03, BP04)	Area located in the centre of the Development Site. Turbine T7 is located within the 250m exclusion zone advised by SEPA. Borrow pits BP03 and BP04 is located within the 250m exclusion zone advised by SEPA. Proposed new access tracks from BP03, to BP04 and from T5 to T1 are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary – Green Beds Formation Low Productivity	All formations which underlie this area are classed as low productivity aquifers in which flow is virtually all through fractures and other discontinues. Peat probing has found peaty soils in the area which range up to 1.0m in depth. The habitats in this area are also generally all confined to the banks of watercourses. Due to the relatively impermeable nature of the solid geology and the presence of peaty soils it is anticipated the habitats in the area will be fed by perched groundwater held within the peat and surface water running into the watercourse. Therefore, it is anticipated that the dependency on groundwater of this habitat is **LOW**.

ID	Location (NGR)	Habitat Type (NVC Identification)	Area (m²)	Land Take (m²)	Dependency Classification	Distance to New Infrastructure: Access Tracks and Shallow Excavations	Distance to New Infrastructure: Turbine (Turbine No) Borrow Pits (BP)	Orientation to New Wind Farm Infrastructure	Underlying Geology and Groundwater Productivity	Conclusion
22	NR 71359 41648	M15	43,150		Moderate	0m	0m (T6, T11)	Area located in the centre of the Development Site. Turbines T6 and T11 are located within the 250m exclusion zone advised by SEPA. Proposed new access tracks from T11 to T13 and to T10 are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary – Loch Tay Limestone Formation, Green Beds Formation Low Productivity	All formations which underlie this area are classed as low productivity aquifers in which flow is virtually all through fractures and other discontinues. Peat probing has found peaty soils in the area which range up to 1.5m in depth. Due to the relatively impermeable nature of the solid geology and the presence of peaty soils it is anticipated the habitats in the area will be fed by perched groundwater held within the peat. Therefore, it is anticipated that the dependency on groundwater of this habitat is **LOW**.
23	NR 71415 41659	M6	11,468		High	0m	0m (T11)	Area located in the centre of the Development Site. Turbine T6 is located within the 250m exclusion zone advised by SEPA. Proposed new access tracks from after EWC 02 to T11 and to T10 are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary – Loch Tay Limestone Formation, Green Beds Formation Low Productivity	All formations which underlie this area are classed as low productivity aquifers in which flow is virtually all through fractures and other discontinues. Peat probing has found peaty soils in the area which range up to 1.5m in depth. The habitats in this area are also generally all confined to the banks of watercourses. Due to the relatively impermeable nature of the solid geology and the presence of peaty soils it is anticipated the habitats in the area will be fed by perched groundwater held within the peat and surface water running into the watercourse. Therefore, it is anticipated that the dependency on groundwater of this habitat is **LOW**.
24	NR 71658 41925	M15	17,595		Moderate	0m	0m (T6, T7, T3, T10)	Area located in the centre of the Development Site. Turbines T3, T6, T7 and T10 are located within the 250m exclusion zone advised by SEPA. Proposed new access tracks to T8 is located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary – Loch Tay Limestone Formation, Green Beds Formation Low Productivity	All formations which underlie this area are classed as low productivity aquifers in which flow is virtually all through fractures and other discontinues. Peat probing has found peaty soils in the area which range up to 1.5m in depth. Due to the relatively impermeable nature of the solid geology and the presence of peaty soils it is anticipated the habitats in the area will be fed by perched groundwater held within the peat. Therefore, it is anticipated that the dependency on groundwater of this habitat is **LOW**.

ID	Location (NGR)	Habitat Type (NVC Identification)	Area (m²)	Land Take (m²)	Dependency Classification	Distance to New Infrastructure: Access Tracks and Shallow Excavations	Distance to New Infrastructure: Turbine (Turbine No) Borrow Pits (BP)	Orientation to New Wind Farm Infrastructure	Underlying Geology and Groundwater Productivity	Conclusion
25	NR 72226 42428	M15	51,452		High	0m	0m (T2, T5, T6, T7, BP01, BP02, BP03, BP04)	Area located in the centre of the Development Site along the existing access track. Turbines T2, T5, T6 and T7are located within the 250m exclusion zone advised by SEPA. Borrow pits BP01, BP02, BP03 and BP04 is located within the 250m exclusion zone advised by SEPA. Proposed new access tracks near T2, to T7, to T6, to T8 and to T10 is located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary - Green Beds Formation Metaigneous Rocks – Amphibolite Low Productivity	All formations which underlie this area are classed as low productivity aquifers in which flow is virtually all through fractures and other discontinues. Peat probing has found peaty soils in the area which range up to 1.5m in depth. The habitat is located on the up-slope side of the existing access track, with the relatively impermeable nature of the solid geology and the presence of peaty soils, it is anticipated the habitats in the area will be fed by perched groundwater held within the peat and surface water running towards the access track and not draining. Therefore, it is anticipated that the dependency on groundwater of this habitat is **LOW**.
26	NR 72982 42908	M6	11,683		High	0m	0m (T2, T5, BP03, BP04)	Area located in the centre of the Development Site along the existing access track. Turbines T2, T5, T6 and T7are located within the 250m exclusion zone advised by SEPA. Borrow pits BP01, BP02, BP03 and BP04 is located within the 250m exclusion zone advised by SEPA. Proposed new access tracks near T2 and near T5 are located within the 100m exclusion zone advised by SEPA.	Drift: Unmapped / Bedrock at or near surface / Glacial Till Solid: Metasedimentary - Green Beds Formation Metaigneous Rocks – Amphibolite Low Productivity	All formations which underlie this area are classed as low productivity aquifers in which flow is virtually all through fractures and other discontinues. Peat probing has generally found peaty soils in the area which range up to 1.5m in depth with isolated areas of deposits up to 4.0m in depth. The habitat is located on the up slope side of the existing access track, with the relatively impermeable nature of the solid geology and the presence of peaty soils, it is anticipated the habitats in the area will be fed by perched groundwater held within the peat and surface water running towards the access track and not draining. Therefore, it is anticipated that the dependency on groundwater of this habitat is **LOW**.

RWE

Clachaig Glen Wind Farm

Environmental Impact Assessment Report

Volume 3

Technical Appendices

Appendix 11.3: Preliminary Peat Landslide Hazard and Risk Assessment

Appendix 11.3 Preliminary Peat Landslide Hazard and Risk Assessment

1. Introduction

1.1 General

1.1.1 RWE Renewables UK Onshore Wind Ltd (the '**Applicant**') is proposing to construct and operate a wind farm and battery storage facility located approximately 20km to the north of Campbeltown and 1.8km to the north east of the small hamlet of Muasdale on the western coast of the Kintyre Peninsula in Argyll and Bute. To be known as Clachaig Glen Wind Farm, the '**Proposed Development'** is planned to comprise up to 12 wind turbines (seven of which will have a maximum tip height of 185m and the remaining five, a maximum tip height of 200m), a battery storage facility with a total capacity not exceeding 30 megawatts (MW) and associated infrastructure. The total generating capacity of the Proposed Development will be in excess of 50MW.

1.1.2 The Development Site comprises the existing access track leading from the A83 to the '**main Development Site**' which will house the wind turbines, battery storage facility and all other associated infrastructure. The existing access track leading from the A83 to the main Development Site is not considered as part of the preliminary Peat Landslide Hazard Risk Assessment (PLHRA), as such the assessment only focuses on the proposed infrastructure within the main Development Site.

1.1.3 AECOM has been commissioned to carry out a preliminary PLHRA to confirm the initial infrastructure design phase.

1.2 Scope of Report

1.2.1 The scope of this report comprises a summary of the methodology used for the preliminary PLHRA; a review and assessment of the baseline conditions emanating from available geological, hydrogeological and topographic information for the Development Site; an estimate of the geotechnical hazards and risks associated with peat slides during and post construction; a qualitative risk assessment in relation to the peat encountered; a summary and discussion of mitigation measures to reduce the risk caused by the presence of peat; and the presentation of any conclusions and recommendations which can be drawn from the information and assessments undertaken as part of this preliminary PLHRA.

1.2.2 Available information includes:

- Digital topographic datasets showing the slope angles within the Development Site,
- Aerial photography,
- Geological datasets showing the published solid and drift geology,

- Information collected during the walkover survey, and
- Peat depths recorded by peat probing surveys.

1.2.3 The methodology generally follows *'Peat Landslide Hazard and Risk Assessments – Best Practice guide for Proposed Electricity Developments*' (Scottish Government, 2017). The guidance follows a staged approach methodology in relation to the peat stability risk as follows:

- Preliminary Assessment,
- Hazard and Risk Ranking,
- Stability Analysis (if required), and
- Detailed Quantitative Risk Assessment (if required).

1.2.4 Ground investigation (GI) data, other than peat depths, is not available at this stage and quantitative slope stability analysis to estimate Factors of Safety has not been undertaken.

1.3 Proposed Infrastructure

1.3.1 The Proposed Development will include the construction of 12 wind turbines and associated infrastructure, namely a permanent anemometer mast, access tracks, watercourse crossings, a temporary construction compound / battery storage facility, small temporary quarries (borrow pits), a control building and substation area. The Proposed Development layout is shown in Figure 11.3.1 (Environmental Impact Assessment Report (EIAR) Volume 3).

1.4 Limitations

1.4.1 AECOM does not warrant or guarantee to any party in any way the completeness or accuracy of the documentary information submitted by third parties during the course of this study. Any assessment(s), interpretation(s), conclusion(s) or opinion(s) contained herein is or are made by AECOM in good faith based on information available at the time of compilation of the report and are made for the sole and exclusive use of the Applicant.

1.4.2 AECOM accepts no liability towards third parties for decisions made by any such based on information or statements contained herein. Third parties making use of any information or statement of any kind whatsoever presented or contained within this report or attachments hereto do so at their own risk.

1.4.3 Where peat depth has been determined through peat probing, it should be noted that due to the nature of the probing, and as no sample is recovered during the advancement of the probe, the peat depth recorded is only an estimate based on the judgement of the probe operator.

2. Methodology

2.1 Desk Top Review

2.1.1 An initial desk top review was undertaken, comprising of the review and analysis of available information detailed below:

- British Geological Survey (BGS) for geology and hydrogeology,
- Scotland's Soils for soil coverage,
- Centre for Ecology and Hydrology (CEH), National River Flow Archive (NRFA) (www.ceh.ac.uk/data/nrfa) for flows and rainfall,
- Scottish Environment Protection Agency (SEPA) (www.sepa.org.uk) for river basin management plans, groundwater classification, groundwater vulnerability, water quality and hydrogeology,
- Aerial Photography, and
- Ordnance Survey maps and Digital Terrain Model (DTM) for topography.

2.1.2 The initial desk top review was carried out by AECOM and the results can be found in Section 3 of this Appendix.

2.2 Good Practice Guidance

2.2.1 The following good practice guidance was used to inform this Appendix:

- Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Scottish Government, 2017),
- SEPA Regulatory Position Statement – Developments on Peat (Scottish Environment Protection Agency (SEPA), 2010),
- Floating Roads on Peat (Scottish Natural Heritage (SNH) and Forestry Commission Scotland (FCS), 2010),
- Constructed Tracks in the Scottish Uplands (SNH, 2015),
- Good Practice during Wind Farm Construction (Scottish Renewables, SNH, SEPA, FCS, Historic Environment Scotland (HES) and Marine Scotland Science (MSS), 2019),
- Guidance on Developments on Peatland, Peatland Survey, on-line version only (Scottish Government, SNH and SEPA, 2017), and
- Developments on Peatland: Guidance on the assessment of peat volumes, reuse of excavated peat and the minimisation of waste (Scottish Renewables and SEPA, 2012).

2.3 Summary of Surveys

2.3.1 The following surveys were undertaken at the main Development Site as part of the 2016 EIA for the Consented Development:

- A site walkover was carried out in September/October 2013,
- Phase 1 Peat Probing was carried out in September / October 2013 and January 2014, and
- Phase 2 Peat Probing was carried out in February 2016.

2.3.2 The following surveys were undertaken at the main Development Site for this EIAR:

- Forest and Land Scotland (FLS) Peat Probing was carried out in September and October 2020,
- A site walkover was carried out in June 2021, and
- An update to the Phase II Peat Probing was completed in June 2021, focusing specifically on areas of the design evolution out with the original probing surveys.

2.3.3 The peat probing locations from the Phase I and Phase II peat probing surveys, are shown in Figure 11.3.2 (EIAR Volume 3).

2.4 Site Infrastructure Design

2.4.1 The peat depth assessments identified that peat depths ranging from 0m to 1.5m cover the majority of the main Development Site, with localised areas where peat depths were recorded up to 5.0m and very isolated locations where recorded peat depths were >5.0m also identified. AECOM's recommended approach is to design the site infrastructure layout to avoid, where possible, areas of peat depth greater than 0.5m.

2.4.2 As widespread areas of peat deeper than 0.5m were encountered, the infrastructure layout was designed to avoid areas of >2m peat depth.

2.4.3 This PLHRA was conducted in general accordance with the guidelines provided in Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Scottish Government, 2017), resulting in a staged approach methodology being followed as shown below:

- Preliminary Assessment, and
- Hazard and Risk Ranking.

2.4.4 A qualitative hazard and risk ranking review was undertaken as part of this PLHRA in accordance with the published Scottish Government (2017) guidance.

2.4.5 A detailed stability assessment and quantitative hazard and risk assessment has not been undertaken at this stage as GI has not been carried out. This PLHRA is therefore preliminary and will require updating on completion of relevant GI.

3. Baseline Environment

3.1 Topography

3.1.1 The main Development Site is characterised by relatively elevated and undulating terrain which falls to the south west with the lowest points present around Clachaig Water at 180m Above Ordnance Datum (AOD).

3.1.2 Ground surface elevations are generally between 180 to 230m AOD, however along the eastern boundary, there is a prominent ridge of open ground with a high point rising to 364m AOD at Cruach Mhic an t-Saoir in the northeast.

3.2 Geology and Soils

Drift Geology (Superficial Deposits)

3.2.1 A review of the BGS online Onshore GeoIndex viewer (BGS, 2021) indicates that the majority of the Development Site has superficial cover of glacial till. The glacial till is likely to consist of poorly sorted sandy, silty clay with potential laminated sand layers and coarse granular material. In areas of raised elevation (e.g. the ridge running along the east side of the Development Site and at Cnoc na Seilg) and locally along the Clachaig Water towards the centre of the main Development Site, the BGS record the absence of superficial cover indicating that rock will likely be encountered at or close to the ground surface. The extent and location of the recorded superficial deposits across the Development Site are shown on Figure 11.3.3 (a and b) (EIAR Volume 3), which is based on Geological Survey of Scotland 1:50,000 solid and drift geology map, sheet 20 and 21W Sound of Gigha.

3.2.2 A supplementary review of the online National Soil Map of Scotland viewer (Scotland's Environment, 2021) shows that the majority of the Development Site comprises peaty gleys. Peat is also noted over a sizeable area in the south of the Development Site.

Bedrock (Solid Deposits)

3.2.3 A review of the BGS online Onshore GeoIndex viewer (BGS, 2021) indicates that the that the majority of the Development Site lies within an area of bedrock dominated by metamorphic rock, namely metalimestone, psammite, semipelite pelite and metavolcaniclastic sedimentary rock. Metaigneous intrusions are present across the Development Site as are two igneous intrusion. Figure 11.3.3 (a and b) (EIAR Volume 3) shows the recorded location of these rock formations in relation to the Development Site.

3.2.4 The Development Site comprises the following succession of metamorphic strata from east to west:

- Beinn Bheula Schist Formation: consisting of gritty psammites and pelites. A thin metaigneous type rock of metamafite is recorded to subcrop in the east of the Development Site which is recorded to be part of the Beinn Bheula Schist Formation,

- Green Beds Formation: consisting of metavolcaniclastic sedimentary rock,
- Glen Sluan Schist Formation: consisting of psammite and semipelite,
- Loch Tay Limestone Formation: consisting of metalimestone, and
- Ben Lui Schist Formation: consisting of semipelite.

3.2.5 The following metaigneous intrusions are present within the Development Site:

- Neoprotorezoic Basic Minor Intrusion Suite: consisting of amphibolite and hornblende schist.

3.2.6 The following igneous intrusions are present within the Development Site:

- North Britain Palaeogene Dyke Suite: consisting of olivine microgabbro.

Walkover Survey

3.2.7 A site walkover was undertaken by an AECOM geotechnical specialist and geologist at the main Development Site between Monday 30 September and Friday 4 October 2013 as part of the 2016 EIA. For the purposes of subsequent reporting, the Development Site was split into areas A-F (Figure 11.3; EIAR Volume 2b) (AECOM, 2021). The findings of this are summarised below:

- The ground comprises densely forested blocks of trees split by breaks, which are sometimes wet and boggy underfoot, particularly in Area B,
- An area of windblown trees is located in the southwest corner of Area A,
- No areas of peat instability were noted,
- Bedrock was noted as being frequently exposed in the open section of the hillside to the east of the Development Site (Area C) and the adjacent sloping forestry ground. Over the central and western areas of the site, shallow / exposed bedrock was frequently noted in access track cuttings, and locally within stream cuttings,
- An existing quarry presumed to be used for the existing access track construction is located adjacent to the site boundary where the access track enters the Proposed Development Site to the north,
- Access tracks throughout the Development Site are generally in good condition with no signs of obvious surface settlement or failures noted and are more extensive than indicated on the existing OS maps,
- A number of substantial turning places were noted off the existing track, and
- No mining features were identified.

3.2.8 Further site visits were undertaken during the subsequent peat probing surveys. The findings of which remain consistent with the abovementioned walkover survey findings.

Peat Probing – Consented Layout

3.2.9 A Phase I peat depth survey was undertaken by an AECOM geotechnical specialist and geologist at the main Development Site between Monday 30 September and Friday 4 October 2013, as part of the site walkover survey noted above. A subsequent visit was then made on Monday 27 and 28 January 2014 to undertake further peat survey work for additional areas within the main Development Site.

3.2.10 A Phase II peat depth survey was undertaken on 9 and 11 February 2016 for the consented layout. Probes were taken at 50m intervals along the proposed access tracks and at key infrastructure locations such as at the turbine locations, the crane pads, the temporary construction compound, the substation and the small temporary quarries.

Forestry Land Scotland (FLS) Peat Probing

3.2.11 Peat probing was undertaken by FLS in September to October 2020. The probing was done as part of FLS' peat restoration plans and the data provided to the Applicant.

Peat Probing – New Application, 2021

3.2.12 Due to the changes to the turbine locations, access tracks and associated infrastructure, additional peat probing was undertaken by AECOM at the main Development Site between Tuesday 28 June and Thursday 01 July 2021 to update the Phase II survey. Probes were taken at 50m intervals along the updated access tracks and at infrastructure locations which had been relocated.

Peat Probing Summary

3.2.13 The results of the probing generally indicate peat depths across the main Development Site vary between being absent and up to 5.0m, with some small, localised areas of peat recorded at greater than 5.0m.

3.2.14 The deepest areas of peat, from 3.0m to greater than 5.0m, were generally encountered to the south of the Development Site in areas of gently sloping topography, often with no trees. Deep peat was also encountered within level areas along the north eastern boundary and locally along the ridge in the east of the Development Site (Area E and Area C, respectively on Figure 11.3; EIAR Volume 2b). In general, areas of the deeper peat encountered were consistent with the peat extents shown on the National Soil Map of Scotland, although locally peat depths encountered were greater than expected over the high ground in Area C and along the north eastern boundary in Area E.

Area A

3.2.15 Across Area A, peat depths are typically less than 0.5m with occasional isolated pockets up to 4.0m.

Area B

3.2.16 Across Area B, there is a variation of peat depths. Peat depths of greater than 5.0m were found at the south of the Development Site. Locally in the north and east of Area B there were areas of up to 5.0m peat depth with the rest of the area generally noted to have a depth up to 1.0m of peat.

Area C

3.2.17 Peat depths were found to vary widely across Area C. Maximum peat depths of greater than 5.0m were encountered in the south east and north east of the area. Otherwise, Area C generally exhibited peat depths of up to 3.0m.

Area D

3.2.18 In Area D peat depths were typically up to 1.50m, however, locally. peat depths of up to 4.0m were encountered with one probe location in the north west of the area indicating a peat depth of up to 5.0m.

Area E

3.2.19 Peat depths were typically less than 1.0m throughout the area, however, locally pockets up to 2.0m were present. Towards the north eastern boundary of the area, in the lower-lying ground, localised peat deposits of up to 3.0m, up to 5.0m and >5.0m were also recorded.

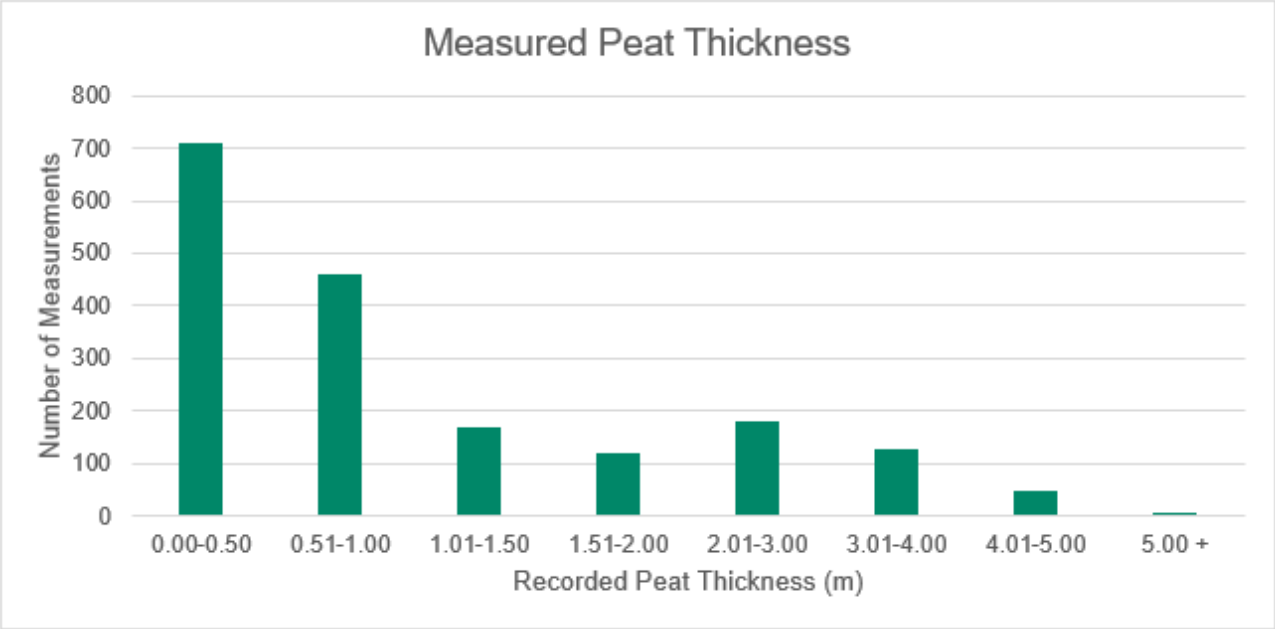
Area F

3.2.20 Area F is out with the Development Site boundary.

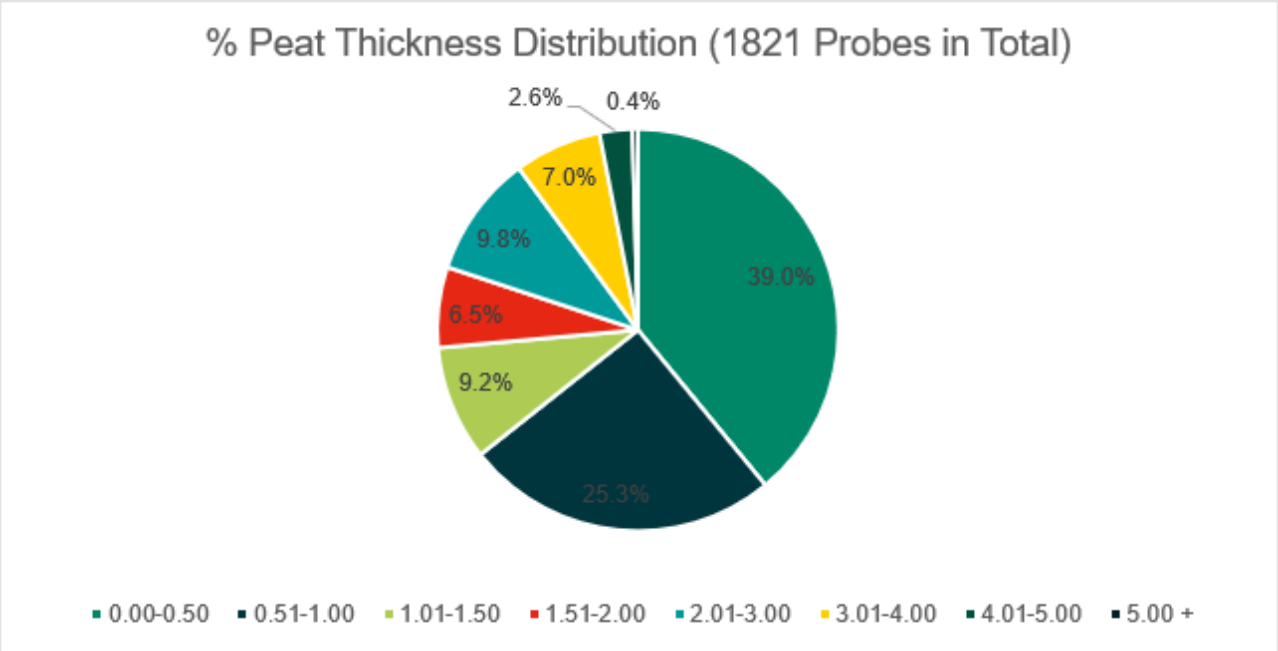
Summary

3.2.21 Insert 1 presents the distribution of peat thickness measurements recorded across the Development Site.

3.2.22 Insert 2 displays the recorded peat depths across the Development Site as a percentage. It can be seen that around 64% of recorded peat depths are 1m or less, with approximately 39% less than or equal to 0.5m.



Insert 1 Peat Thickness Measurements Recorded Across the Main Development Site



Insert 2 Recorded Peat Depths Across the Development Site as a Percentage

3.3 Hydrology

3.3.1 A review of the 1:625,000 scale Hydrogeological map of the UK, accessed via the BGS onshore GeoIndex (BGS, 2021) identified that the entirety of the Development Site was underlain by a low productivity aquifer of the Southern Highland Group and Argyll Group. The BGS indicated that 'small amounts of groundwater in or near surface weather one and secondary fractures'.

3.3.2 In accordance with BGS Aquifer Productivity GIS Report OR15003, the majority of the Proposed Development is considered as 'not a significant aquifer' as a result of widely spread glacial till on site. In areas where alluvium deposits and/or areas of significant peat deposits were identified, aquifers

of moderate to high productivity were identified. No other groundwater features were noted during the site walkover.

Groundwater Dependent Terrestrial Ecosystems (GWDTEs)

3.3.3 National Vegetation Classification (NVC) Surveys reported in Chapter 9: Ecology (EIAR Volume 2a) identified specifies which are classified by SEPA as potentially groundwater dependent in their *'Land Use Planning System SEPA Guidance Note 4*' (SEPA, 2017). The following habitats, which are potentially dependent on groundwater (i.e. can be classed as GWDTEs), have been identified within the Development Site and are discussed in Appendix 11.2 (EIAR Volume 3).

- M15 Scirpus cespitosus - Erica tetralix wet heath,
- W4 Betula pubescens - Molinia caerulea woodland,
- M23 Juncus effusus/acutiflorus - Galium palustre rush-pasture,
- M6 Carex echinata - Sphagnum recurvum mire, and
- MG10 Holcus lanatus - Juncus effusus rush-pasture.

3.3.4 Depending on the hydrological setting, habitats M15 and MG10 are potentially moderately dependent on groundwater and habitats W4, M23 and M6 are potentially highly dependent on groundwater.

3.3.5 The GWDTE boundaries were defined either by the spatial extent of a single habitat type or by defining a wider area which encompassed a group of small, isolated habitats with similar habitat characteristics and the same dependency classification.

3.3.6 A total of seventeen GWDTEs were defined within the main Development Site. The locations of the GWDTEs, together with the 100m and 250m buffers recommended by SEPA, are shown on Figure 11.7 (EIAR Volume 2b) (AECOM,2021).

3.3.7 The GWDTEs and their buffers cover a large proportion of the main Development Site. As such, it was not possible to design the Proposed Development such that turbines and other infrastructure avoided all of the GWDTEs or their buffer zones. An assessment of the potential impact upon the identified GWDTEs and likely groundwater dependence of these habitat areas has therefore been undertaken and the results are outlined in detail within Appendix 11.2 (EIAR Volume 3). The ecological impacts of the Proposed Development on the habitats noted above are addressed in Chapter 9: Ecology (EIAR Volume 2a).

3.3.8 Groundwater dependency of the GWDTEs was assessed considering information on topography, habitat type, underlying geology and hydrogeology. The underlying geology of the Development Site is largely impermeable and is classified as a low productivity aquifer in which flow is virtually all through fractures and other discontinuities.

3.3.9 Areas where GWDTEs are present typically correspond to areas where shallow groundwater is likely to be within glacial till deposits and / or peaty soils where perched groundwater is present.

Groundwater Vulnerability

3.3.10 A review of Scotland's Environment Groundwater classification layer on its online map (Scotland's Environment, 2021), the Development Site lies within the Oban and Kintyre waterbody with an overall classification of good. The BGS Groundwater Vulnerability (Scotland) dataset Version 2 (BGS, 2015) indicated that the Development Site generally lies within a vulnerability class of 4, defined as 'vulnerable to those pollutants not readily absorbed or transformed' and, due to the presence of rock at or near to ground surface within the Development Site, vulnerability class 5 – 'vulnerable to most pollutants with rapid impact in many scenarios.

3.4 Surface Hydrology

3.4.1 The hydrology of the Development Site is illustrated in Figure 11.3.6 (EIAR Volume 3) (AECOM,2021).

3.4.2 Figure 11.3.6 (EIAR Volume 3) identifies several Water Environment (Controlled Activities) (Scotland) Regulations 2011, as amended ('**CAR**'), licenses across the Development Site. This is discussed in Chapter 11: Geology, Hydrology and Hydrogeology (EIAR Volume 2a) (AECOM,2021).

3.4.3 The majority of the Development Site is drained by the Clachaig Water and its tributaries which originates in Loch na Naich to the northeast of the Development Site and flows in a south westerly direction into the Sound of Jura.

3.4.4 The area of the Development Site located to the east of the rocky ridge, which runs north to south along the eastern boundary, drains into the Barr Water. The Barr Water is located outwith the Development Site and originates from Loch Losgainn, located to the northeast of the Development Site. This watercourse flows in a south / south westerly direction, adjacent to the eastern boundary of the Development Site and eventually drains into the Sound of Jura.

3.4.5 There are various unnamed tributaries which drain into both the Clachaig Water and Barr Water and are present across the Development Site, as well as numerous minor artificial land drains associated with the forestry plantation.

3.4.6 The National River Flow Archive (NRFA) indicated that within 10km of the Development Site, one flow gauge was present. The gauge is located approximately 6.8km east southeast of the Development Site on the Carradale Water at Dippen. As no water from the Development Site drains into Carradale Water, the flow gauge and any data is not considered relevant to the Proposed Development.

Flooding

3.4.7 A review of SEPA's online indicative flood map shows that the Development Site can be subject to river flooding and surface water flooding. The likelihood of river flooding in the Clachaig Water is classed as being High, and the likelihood of surface water flooding is classed as High in a few small and localised instances. The Barr Water has associated floodplains located out with the Development Site.

3.4.8 Although the likelihood of river flooding is classed as being High, the extent of the flooding is wholly contained within the banks of the Clachaig Water. Surface water flooding is shown as a series of small areas of High likelihood, which is likely associated with the peat deposits present across the Development Site.

3.4.9 Based on this screening review, it is considered that flooding is isolated within the banks of the Clachaig Water or to small, localised areas of surface water and therefore the area can be considered to be a low-risk area for flooding. No further assessment is required to be undertaken in terms of flood risk to the Proposed Development.

3.4.10 Due to the minimal areas of hardstanding proposed, it is considered that the Proposed Development would not significantly increase the risk of downstream flooding. A flood risk assessment (FRA) is not considered to be required in this instance and as such, it has been scoped out in accordance with SEPA's (2017) '*Land Use Planning System – Guidance Note 4*' which states "*Where flooding may be an issue a flood risk assessment should also be submitted".*

Climate

3.4.11 Rainfall data from the Carradale Water at Dippen flow gauge is available from the NRFA. It can be seen in Table 1 Spatial Rainfall Information that the annual average rainfall is approximately 1,800mm in the vicinity of the Development Site. To put this data into context, based on publicly available data from the Met Office, the wettest part of the UK is the north west of Scotland which has an annual average rainfall in excess of 3,000mm and the driest part is the south east of England with less than 600mm. Therefore, it can be expected that the Development Site is likely to experience medium to high rainfall during construction, operation and decommissioning.

Table 1 Spatial Rainfall Information

Flow Gauge Station	NGR	Period of Record	Annual Average Rainfall (mm)
88001- Carradale at Dippen	NR 797376	1961-1990	1,819

Water Quality

3.4.12 SEPA's current River Basin Management Plan (RBMP) classifications for the catchments associated with the Development Site are detailed in Table 2 RBMP Classifications. All identified water bodies have an overall status of 'Good'.

Table 2 RBMP Classifications

Water Body Name	Category	Overall Status	Ecological Status
Clachaig Water	River	Good	Good
Barr Water	River	Good ecological potential	Moderate
Oban and Kintyre	Groundwater	Good	-
Mull of Kintyre	Coastal	Good	Good

3.5 Designated Sites

3.5.1 The entire Development Site is underlain by the Oban and Kintyre groundwater body, designated by SEPA as a Drinking Water Protection Zone.

3.5.2 No designated sites are located within or adjacent to the Development Site.

3.6 Slope Analysis

3.6.1 A 5m Digital Terrain Model (DTM) was used to complete a slope assessment of the Development Site, as shown on Figure 11.3.4 (EIAR Volume 3). This found that the Development Site generally has slope gradients ranging between 0° and 10°.

3.6.2 Localised areas of slope gradient ranging between 10° and >20° are located in the east and north east of the Development Site where the slopes form the valley of the Clachaig Water, which flows in a north east to south west direction; in the west of the Development Site on the south east facing slopes; and in the north west of the Development Site at the proposed location of Turbine T03, where the north west facing slopes form the valley of the Allt Achadh á Choirce, which flows in a north east to south west direction and drains into the Clachaig Water.

3.7 Geomorphology

3.7.1 The geomorphology of the Development Site is dominated by the topography and resulting drainage pattern. The topography of the site consists of predominantly undulating hills with one steep sided valley, Clachaig Glen, and several smaller valleys which connect to the lowest points present around Clachaig Water at 180m AOD.

3.7.2 The eastern boundary is dominated by a prominent ridge of open ground with a high point rising to 364m AOD at Cruach Mhic an t-Saoir in the north east. Due to the topography of the terrain, the area presents localised rock outcrops and low depressions with peat.

3.7.3 The Development Site drainage is dictated by the watershed which generally flows in a south westerly direction towards Clachaig Water before it exits through the western boundary into the Sound of Jura.

3.8 Land Use

3.8.1 The majority of the Development Site is dedicated to plantation timber (coniferous wood) production operated by Forest and Land Scotland (FLS). The eastern and central northern areas of the land available for development, comprises an area of heath and rough grassland. A north east to south west trending unbound forestry access track extends through the centre of the Development Site from the northern boundary to around Achaglass in the south west.

3.9 Quarrying

3.9.1 A review of the OS mapping did not identify any quarrying activity within the Development Site, but several quarries are located in the vicinity to the north and north east of the land available for

development and shown as disused. The location of this quarry is shown on Figure 11.3.2 (EIAR Volume 3).

3.9.2 A review of the aerial photography identified a quarry to the north located adjacent to the Development Site boundary, where the access track enters the Development Site. This was confirmed during the site walkover in June 2021.

3.9.3 The Coal Authority Interactive Map viewer (cite) indicates that the Development Site is not recorded to be within development high risk area with no known past shallow coal mining workings or probably shallow coal mine workings shown. Furthermore, no mine entries are recorded underlying or in close vicinity to the Proposed Development and the rock type underlying is not recorded to be coal bearing.

3.10 Forestry

3.10.1 The Development Site is dominated by coniferous woodland which is primarily used for plantation forestry.

3.11 Historical Landslide

3.11.1 A review of the BGS online Onshore GeoIndex viewer and historical maps has not identified any historical landslides within the Development Site.

4. Peat Stability Risk Assessment

4.1 General

4.1.1 Due to the presence of peat accumulations across the Development Site, a preliminary PLHRA was carried out to assess the risks posed by such soils to the Proposed Development. This assessment has been carried out in general accordance with the Scottish Government's '*Peat Landslide Hazard and Risk Assessments – Best Practice guide for Proposed Electricity Developments*' (Scottish Government, 2017).

4.1.2 Peat slides can represent a significant hazard and can occur during the construction, operation and decommissioning phases of a development. The nature of wind farm developments in Scotland often situates them in areas where peat moorland is typically found, and it is inevitable that some alteration of the local hydrological regime of a site will occur due to the design and construction practices of such a development.

4.1.3 It is widely considered that development in areas of peat accumulation can have an effect on the stability of these soft soils through alteration of the drainage regime, alteration of loadings (both temporary loads during construction and final working loads), alteration of land use (e.g. removal of surface vegetation) and alteration of the topography. Any proposed development within such an area requires a PLHRA to characterise the site, identify issues and develop the required construction mitigation measures to reduce the risk of a failure occurring within the peat.

4.1.4 This preliminary PLHRA is a qualitative assessment based on an examination of available topographical maps and aerial photography, a digital terrain model, observations made during site visits, an assessment of peat probing results and engineering judgement.

4.1.5 As per the guidance set out by the Scottish Government (Scottish Government, 2017), peat is defined in the following way:

- Peaty or organo-mineral soil: a soil with a surface organic layer less than 0.5m deep,
- Peat: a soil with a surface organic layer greater than 0.5m deep which has an organic matter content of more than 60%, and,
- Deep peat: a peat soil with a surface organic layer greater than 1.0m deep.

4.1.6 It can be inferred from the Scottish Government's guidance that peat is a soil which can be particularly sensitive to variations in rainfall and subsequent surface and groundwater changes.

4.1.7 Peat slides can occur on slopes with angles from as little as 2 – 5° and peat thickness of 1 – 3m. Table 2.1 in the Scottish Government's guidelines summaries the various types of peat landslide and the associated typical conditions required for such a failure.

4.1.8 The key considerations of this assessment are that:

- Existing, historical or potential areas of instability are identified, and
- The Proposed Development, including construction works, does not result in an unacceptable risk of peat failure.

4.2 Factors Controlling Peat Instability

4.2.1 Peat instability can be caused by several factors which can be split into two groups – triggering factors and preparatory factors. Triggering factors have an immediate or rapid effect on the stability of a peat deposit whereas preparatory factors can influence peat stability over a much longer period.

4.2.2 The main triggering factors of peat slides include:

- High intensity and prolonged rainfall, in particular following dry period,
- Peat extraction,
- Peat loading, and
- Ground subsidence associated with collapse of shallow underground mineworkings and / or abandoned mine entries in areas of historical mining.

4.2.3 The main preparatory factors, which may increase the risk of failures occurring include:

- Alteration of the hydrological regime,
- The effects of topography, and
- Tree felling / deforestation.

4.2.4 While peat failures are often considered to originate in thick or extensive accumulations, it should be noted that instability can still occur in areas of limited peat thickness. The nature of the peat and the interface between the separate layers can also influence its stability. The plane of failure is often located at the interface between the upper, periodically saturated layer (the acrotelm) and the underlying permanently saturated layer (the catotelm), although it may also be located at the interface between the peat and underlying material.

4.2.5 Failure can occur due to heavy or prolonged rainfall where groundwater builds up within a peat accumulation exerting an increased pressure on the soil. This can be exacerbated by drying out of the peat (in summer months for example) leading to the formation of desiccation cracks which can in turn fill with water during rainfall resulting in increased pore water pressures and potentially failure. However, the influence of rainfall on potential peat failure is considered to be heavily dependent on the natural drainage regime within the peat.

4.2.6 Peat extraction can generate new drainage pathways, leading to a concentration of surface and / or groundwater flow and subsequently resulting in either increased erosion or concentration of water within localised areas of the accumulation. Extraction can also have the effect of releasing the confining pressures acting on the peat, which can lead to the development of tension cracks in adjacent peat accumulations as a result of the loss in lateral support.

4.2.7 Loading of peat can also generate the formation of tension cracks through compression and bulging of underlying or adjacent peat soils. In such a case, depending on the topography, the strength of the peat may be dramatically reduced due to the alteration in loading and rainfall may not be required to initiate a failure.

4.2.8 Ground subsidence associated with the collapse of shallow underground workings and / or abandoned mine shafts may trigger localised peat slumps. Peat failures initiated by mining subsidence could be expected to typically involve peat slumping in towards the area affected by subsidence and their scale would be dependent on a number of factors including the depth of the peat deposits, the nature of the local hydrological regime and the topography of the surrounding area.

4.2.9 Tree felling, even where affected areas are subsequently re-planted, can impact upon the hydrogeological regime through reduced groundwater extraction and altered drainage pathways. This can lead to increased peat erosion and an increase in groundwater pressures within the peat accumulation, both of which can increase the risk of peat failure.

4.2.10 Permanent deforestation in peat areas can have an effect on the stability of a peat accumulation due to the removal of potentially stabilising root systems and reduction of groundwater extraction by the trees. Over time, the increase in groundwater can lead to an alteration of drainage pathways, localised or potentially extensive erosion with the peat and the concentration of localised groundwater pressures.

4.2.11 Peat accumulations are typically thickest in reasonably flat lying areas or topographic hollows where surface and groundwater drainage is often concentrated and thins as the local slope angle increases.

On steep slopes of around ≥20°, the conditions are generally considered too steep for thick peat to form, although some peat may be present.

4.2.12 Peat failures can occur on gentle slopes, just as on steeper slopes, depending on the loading and drainage conditions and the condition of the peat structure. Changes in gradient, including the subsurface gradient of underlying strata, can also contribute to peat failure due to the potential concentration of pore water pressures within both concave and convex slope profiles and the gravitational effects on the peat mass.

4.2.13 Alteration of the hydrological regime can have long-term and far-reaching effects on the stability of peat accumulations. Areas of blanket bog generally have limited drainage and as such are considered to represent a greater risk of instability due to the associated high water table and hence, such areas are more sensitive to change in drainage regime. Alteration by diverting or blocking either man-made or natural surface drainage pathways or the proposed development of new ditches can transport and concentrate water into areas of potential instability.

4.2.14 Within peat accumulations, groundwater will generally flow more readily within the upper acrotelm layer relative to the underlying less permeable catotelm. Excavations within peat soils will influence existing drainage paths and local permeability. The construction of a wind farm will potentially generate an area of hydrological sensitivity due to the free draining nature of the construction stone.

4.3 Consequences of Peat Failure

4.3.1 A key part of the risk assessment process is to identify the potential scale of peat failure should it occur and identify the receptors of the consequences. For the Development Site, the key potential sensitive receptors of peat failure are:

- The turbines and other associated site infrastructure (damage to turbines, tracks etc.),
- Site workers and plant (risk of injury / death or damage to plant),
- Wildlife (disruption or destruction of habitat),
- Watercourses and aquatic fauna,
- Site drainage (blocked drains / ditches leading to localised flooding / erosion), and
- Visual amenity (scarring of landscape).

4.4 Triggering and Preparatory Factors

4.4.1 The following provides a summary of the relevant triggering and preparatory factors which relate to the Proposed Development:

- Rainfall is not a controllable factor. However, the assessment considers the potential effects of heavy rainfall at the Development Site,
- Peat loading, and peat extraction are potential hazards. However, both can be mitigated through particular working methodologies (to be identified in the site-specific construction methodology documents to be prepared by the construction Contractor prior to construction),

- The topography of the Development Site is characterised by relatively elevated and undulating terrain and the assessment should take cognisance of the combined topography and peat thickness, and
- The creation of new drainage paths may lead to the potential channelling and ponding of run-off in areas of the Development Site, posing a potential hazard. This hazard can be minimised through the adoption of particular working methodologies (to be confirmed in site-specific construction methodology documents).

4.4.2 Working methodologies / mitigation measures referred to above are discussed further in the 'Mitigation Measures' section of this report.

4.5 Qualitative Risk Assessment

4.5.1 A Qualitative Risk Assessment ('Hazard Ranking') was undertaken by identifying the factors that can cause landslide events and estimating the impact of such events on the Proposed Development. The Hazard Ranking has been undertaken in accordance with the Scottish Government guidance (Scottish Government, 2017).

4.5.2 The Hazard Ranking was calculated using the following equation:

Hazard Ranking = Hazard x Exposure

4.5.3 The terms Hazard and Exposure are defined in this case as "*the likelihood of the peat landslide event occurring" and "the impact and consequences that the event may have*", respectively.

4.5.4 The Hazard scale used in this assessment is shown in Table 3, which is based on the scale recommended in Table 5.1 of the Scottish Government guidance.

Table 3 Qualitative Assessment of Peat Landslide Hazard over the Lifetime of the Proposed Development

Scale	Likelihood	Probability of Occurrence
5	Almost certain	> 1 in 3
4	Probable	1 in 10 – 1 in 3
3	Likely	1 in 10^2 – 1 in 10
2	Unlikely	1 in 10^7 – 1 in 10^2
1	Negligible	< 1 in 10^7

4.5.5 The Exposure scale used in this assessment is shown in Table 4, which is based on the scale recommended in Table 5.2 of the Scottish Government Guidance.

Table 4 Qualitative Assessment of Peat Landslide Exposure over the Lifetime of the Proposed Development

Scale	Exposure	Impact as % damage to (or loss) of project	Example
5	Extremely high	> 100% of the project	Loss of life or serious injury, major pollution incident, destruction of property or infrastructure or public road, major loss of habitat.
4	Very high	10% – 100%	Minor or non-serious injury, minor damage to property or temporary closure of infrastructure, significant pollution incident or significant loss of habitat.
3	High	4% – 10%	Minor pollution incident, destruction of access track locally, significant delay to construction, localised loss of habitat.
2	Low	1% – 4%	Temporary closure of forest roads, minor delay to construction.
1	Very low	< 1% of the project	Minor remediation of infrastructure or habitat.

4.5.6 Once all areas within the Development Site have been assigned a peat landslide probability and degree of adverse consequence, a Hazard level can be estimated for each area, and the peat landslide map prepared for the Development Site. The indicative Hazard levels used in this assessment is shown in Table 5, which is based on the scale recommended in Table 5.3 of the Scottish Government guidance.

Table 5 Indicative Hazard Levels

Peat landslide probability or likelihood	Adverse Consequence				
	Extremely High	**Very High**	**High**	**Low**	**Very Low**
Almost Certain	High	High	Moderate	Moderate	Low
Probably	High	Moderate	Moderate	Low	Negligible
Likely	Moderate	Moderate	Low	Low	Negligible
Unlikely	Low	Low	Low	Negligible	Negligible
Negligible	Low	Negligible	Negligible	Negligible	Negligible

Where the hazard level for a zone is moderate or high, avoidance or specification of mitigation measures would normally be the only means by which project infrastructure could be considered acceptable within that zone at the Development Site.

4.5.7 The need for further investigation or specification of mitigation measures should be a function of the risk level present on the Development Site. The Risk Ranking and suggested actions used in this assessment are shown in Table 6, which is based on the scale recommended in Table 5.4 of the Scottish Government guidance.

Table 6 Hazard Ranking and Suggested Actions

Risk Level	Action suggested for each zone
High	Avoid project development at these locations
Medium	Project should not proceed unless risk can be avoided or mitigated at these locations, without significant environmental impact, in order to reduce risk ranking to low or negligible.
Low	Project may proceed pending further investigation to refine assessment and mitigate hazard through relocated or re-design at these locations.
Negligible	Project should proceed with monitoring and mitigation of peat landslide hazards at these locations as appropriate.

4.6 Estimating the Hazard

4.6.1 To estimate the level of hazard, the inputs used have been based on the major factors that can affect slope stability at the site, namely: slope angle, peat thickness, signs of relic or incipient peat failure, presence of forestry and hydrology. The selection of the ranges for ranking of these inputs was based on literature review, site evidence and engineering judgment, as advised by the Scottish Government (Scottish Government, 2017) and discussion on the rankings chosen for each of the main factors is given in the following sections.

4.7 Slope Angle

4.7.1 Gravity is the primary driving force of all landslides and as such, slope angle is a significant factor in controlling the stability of peat soils.

4.7.2 Although peat is known to have failed on relatively gently sloping land, with the majority of failures occurring on ground sloping between 4° and 8°, this is likely to correspond to these slope angles being favourable to significant peat accumulation, and therefore more closely linked to the thickness of peat (Boylan N, et al, 2008).

4.7.3 Shallower sloping ground is considered to have a reduced likelihood of failure, since there is less gravitational force to facilitate instability, and as such gentle slopes are not considered to be as susceptible to failure as steeper slopes.

4.7.4 As a result, assigned rankings relating to slope angle vary between 0.5 (where slopes are almost flat) and 5 (where steep slopes with greater gravitational forces acting on them are present), as presented in Table 7.

Table 7 Slope Angle Ranking (Ranking Factor 1)

Slope Angle (°)	Ranking
0 – 2	0.5
< 2 - 5	1
< 5 - 10	2
<10 - 15	3

Slope Angle (°)	Ranking
<15 - 20	4
≥ 20	5

4.8 Peat Thickness

4.8.1 Mills, A.J (2002), submitted for the degree of Doctor of Philosophy, University of Durham, reports that peat slides most frequently occur in peat accumulations between 0.5m and 1.5m in thick, while bog bursts commonly occur in peat ranging between 1.0m and 5.0m. Peat slides are defined as "*slab-like, shallow translational failures with a shear failure mechanism operating at, or just below, the peat and underlying substrate interface*" (Warburton J, et al, 2004), whilst bog bursts "*involve large quantities of water and peat debris that flows downslope…usually associated with raised bogs*" following bursting of peat in a near-liquid state through tears in the surface layers, possibly as a result of a build-up of hydrostatic pressures within the peat.

4.8.2 Peat failure may be facilitated through the development of weak layers within the peat mass which may either form naturally, or by 'hydrological factors'. Peat has a natural anisotropic strength due to the process by which it is formed. In particular, the nature of the interface between the distinct layers within a peat mass is defined by hydrology. These distinct layers are:

- An upper vegetative mat consisting of the living vegetation of herbaceous plants, grasses and mosses,
- The acrotelm, which is described as the surface layer of an active peat forming mire, which is generally composed of recently deposited material and within which the water level fluctuates (i.e. aerobic conditions), and where water moves more freely than in the lower layers. This layer typically consists of 'fibrous' peat and generally ranges between 0.2m and 1.0m in thickness, but may vary depending on seasonal and other variations,
- The catotelm, which comprises the lower layer of an active peat forming mire which remains permanently waterlogged and through which water usually moves less freely. Its thickness can vary up to several metres, with its base defining the bottom of the peat mass. In terms of identification and description, this layer corresponds with the 'pseudo fibrous' through to 'amorphous' descriptors.

4.8.3 It is considered that the nature of the boundary between the acrotelm and catotelm, and between the catotelm and the underlying substrate (e.g. mineral soil, weathered rock) influence the strength of the peat mass (JNCC, 2011).

4.8.4 Peat stratification and thickness are associated with one another. This is due to the fact that thin deposits of peat are unlikely to have a catotelm and may mainly be composed of a vegetative mat and acrotelm. As such, with inherent strength as a consequence of a more fibrous morphology, peat thicknesses of less than 0.5m are not reported to fail catastrophically. However, thicker deposits are more likely to contain weaker layers or bands of pseudo fibrous / amorphous peat, which are more likely to fail.

4.8.5 For the purposes of this assessment, peat thickness has been ranked between 0.5 and 4, increasing with depth, where increasing values relate to more onerous conditions, reflecting the tendency for 'weaker' peat to be present as thickness increases in addition to the presence of a greater disturbing force as a consequence of the increasing thickness. The ranking adopted for peat thickness is given in Table 8.

Table 8 Peat Thickness Ranking (Ranking Factor 2)

Peat Thickness (m)	Ranking
≤ 0.5	0.5
>0.5 - 1.0	1
>1.0 - 2.0	2
>2.0 - 3.0	3
> 3.0	4

4.9 Evidence of Peat Instability

4.9.1 Evidence of previous or incipient peat instability may provide an indication that conditions at that location are favourable to peat instability and therefore the area may be prone to further instability. As such, it is considered that areas with evidence of peat instability will have a higher risk of failure than areas where no stability issues have been identified.

4.9.2 For the purposes of this assessment, where no peat instability is identified through the desk study or site visit, a ranking of 0 is applied. Where localised small-scale failures are identified, a ranking of 1 is used and where more widespread or large-scale failures are identified, a ranking of 2 is applied, as indicated in Table 9.

Table 9 Signs of Relic Failure Ranking (Ranking Factor 3)

Signs of relic failure in vicinity	Ranking
Absent	0
Localised evidence of instability	1
Widespread evidence of instability	2

4.10 Presence of Forestry

4.10.1 The process of afforestation and subsequent deforestation can have significant effects on the structure and hydrological properties of peat soils, which may in turn result in an increased risk of peat failure.

4.10.2 During the planting operations, a series of drains are cut into the peat soil across the area to be afforested. These drains are typically between 0.4m and 0.6m deep and are cut perpendicular to the surface contours to allow drainage of the soils to fall away from the plantation (Wilson, P. et al. 1993). This process initially affects the structure and hydrology of the upper acrotelmic layer of peat.

4.10.3 Over the years and decades that follow initial planting, drying out and degradation of the peat adjacent to the furrows results in their widening. As the trees mature and their canopies grow, an increase in the capacity of trees to intercept rainfall and for evapotranspiration to occur results in further drying of the peat. Dry summers can also exacerbate the drying effects on the peat, with water uptake by root systems replacing drainage as the main cause of peat drying, resulting in the water table falling below the base of the furrows and causing cracking to extend deeper into the catotelmic material. Eventually, the drying effects can cause the peat to crack, which typically follows the lines of drains / furrows.

4.10.4 As the plantation matures, the peat is subject to progressive loading from the growing trees. Additional loading of the peat is caused by the drainage of the peat, resulting in a loss of the buoyancy from saturated peat. Over the lifetime of the forest, drainage ditches can become blocked due to the trees shedding their needles / leaves, ground vegetation cover infiltrating them and soils washing into them causing them to silt up. This can prevent water draining away as intended and cause an increase in pore water pressure following periods of heavy rainfall. As such, the process of afforestation can have a negative effect on the stability of peat.

4.10.5 Following deforestation, peat loading from the trees is largely removed, and a rise in the water table results in further reduction of loading due to the buoyancy of peat particles once again. However, with the reintroduction of water, an increase of pore water pressure may again be established within the peat mass. Deforestation is also considered to have a negative effect on peat stability but is considered less of a concern than when forested due to the overall reduction of peat loading.

4.10.6 Therefore, the following ranking for the presence of forestry is considered appropriate for this assessment, as shown in Table 10.

Table 10 Presence of Forestry Ranking (Ranking of 4)

Presence of Forestry in the Area	Ranking
Absent	0
Recently deforested	1
Present	2

4.11 Hydrology

4.11.1 An increase in pore water pressures generated by intense rainfall is a significant potential ‘trigger mechanism’ for peat slides. However, prolonged periods of heavy rainfall are not necessarily related to instability. Both the distribution and intensity of precipitation have a complex influence on the mass movement of peat (Carling, P., 1986).

4.11.2 In many cases of peat failures, a relatively dry period has been followed by intense rainfall. Although intense rainfall appears to be an important factor, it is important to recognise that the occurrence of an extreme event does not necessarily directly result in peat instability, this being a function of many factors and a combination of climatic preparatory events. For the purpose of this assessment, rainfall has been considered to be a constant for the entire site.

4.11.3 It has been noted that peat slides have been initiated along natural drainage lines or in association with artificial drainage (JNCC, 2011). Blocking of existing drainage paths could create a buoyancy effect which may reduce the strength of the peat or cause liquefaction due to raised pore water pressures at the base of the peat.

4.11.4 Poorly drained areas (such as boggy ground with few / no drainage channels) are considered to be more susceptible to instability due to higher groundwater tables than well-drained areas.

4.11.5 Where drainage ditches become blocked with vegetation for example, water can build up in them allowing pore water pressures to develop and exceed critical levels during or immediately following intense rainfall. This is likely to be the case for the majority of the Development Site, where forestry is or has been present and where vegetation is likely to have blocked many of the drainage paths.

4.11.6 The parameter for hydrology has been given a ranking value of between 0.5 and 2 as shown in Table 11. Increasing values relate to relatively poorer drainage conditions that are considered likely to increase the probability of instability occurring.

Table 11 Hydrology Ranking (Ranking Factor 5)

Hydrology description	Ranking
Well drained with a good drainage system in working order	0.5
Boggy or saturated ground	1
Blocked drainage paths	2

4.12 Weightings

4.12.1 The above factors are not considered to contribute equally to peat instability and as such, weightings have been applied to each of them.

4.12.2 For example, as slope angle is considered to represent one of the main driving forces for peat instability, a weighting of 6 has been assigned to the rankings to capture its importance in the mobility of peat. Likewise, evidence of peat instability is considered to be equally influential, as if the conditions in areas have resulted in failures in the past, similar failures could initiate in the future and therefore a weighting of 6 has also been assigned to this factor.

4.12.3 Peat depth is also considered to play a significant role in the stability of peat: as the thickness of peat increases, so does the weight of the peat, which could result in the activation of a slip plane. Also, due to the anisotropic nature and highly variable structure of peat, the thicker the deposits are, the more likely to have a greater number of weaker zones throughout its profile affecting the overall stability of the peat mass. This factor is, however, considered less likely to influence the stability as the slope angle and evidence of peat instability and has therefore been given a lower weighting value of 4.

4.12.4 Forestry plays a significant role on peat stability on the Development Site due to its extensive coverage. The planting process will likely have caused damage to the structure of the upper layer, and the additional loading of the peat from the weight of the trees coupled with the degradation of

the peat by their drying out resulting in increased risk of peat instability. However, this is not considered to be as significant a factor as peat thickness and has therefore been assigned a value of 3.

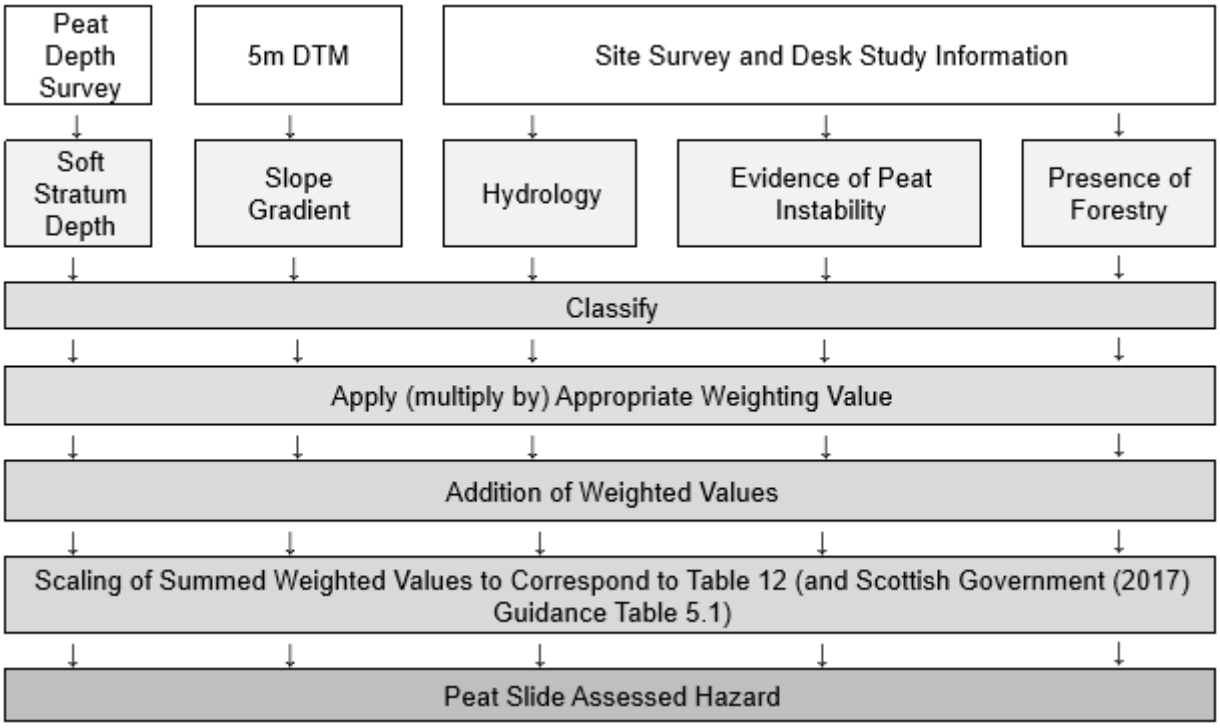
4.12.5 Finally, the hydrology of the peat is also considered to contribute to the stability of peat. However, due to the extent of the forestry across the Development Site, hydrology is considered to be less influential at this site. This is because the hydrology is closely related to the drainage network throughout the forestry and this factor is therefore linked to and largely covered under the weighting applied to the forestry. However, it is still important to consider this factor, and as such has been assigned a weighting of 2.

4.12.6 The weightings assigned to each of the factors are summarised in Table 12.

Table 12 Weightings

Layer	Ranking Factor	Weighting
Slope Angle	1	6
Peat Thickness	2	4
Signs of Relic Failure	3	6
Forestry	4	3
Hydrology	5	2

4.12.7 To estimate the level of hazard across the Development Site and produce the Peat Slide Assessed Hazard (PSAH) plan, the classification and weighting was carried out in geographic information systems (GIS) software using a multi-criteria analysis. The processed used is illustrated in Insert 3.



Insert 3 GIS Multi-criteria Analysis for the PLHRA Plan

4.12.8 The scaling of the Weighted Totals corresponding to Table 12 (and the Scottish Government Guidance Table 5.1) is shown in Table 13.

Table 131 Weighted Total vs Scale

Weighted Total	Scale	Likelihood	Probability of Occurrence
> 50	5	Almost certain	> 1 in 3
41 – 50	4	Probable	1 in 10 – 1 in 3
31 – 40	3	Likely	1 in 10^2 – 1 in 10
21 – 30	2	Unlikely	1 in 10^7 – 1 in 10^2
<21	1	Negligible	<1 in 10^7

4.12.9 The assessed potential peat slide Hazard presented in Figure 11.3.7 (EIAR Volume 3) indicates that the potential peat slide Hazard across the Development Site is generally assessed to be 'Negligible' (1) or 'Unlikely' (2), with areas of 'Likely' (3) in isolated pockets and along the east of the Development Site, adjacent to the existing track and site boundary. The largest areas classed as 'Likely' coincide with >20° slope angles, however these are areas not proposed to be developed.

4.12.10 The majority of the proposed infrastructure is located in areas assessed as 'Negligible' or 'Unlikely' potential peat slide Hazard and typically only very isolated pockets classed as 'Likely' Hazard are proposed to be developed, as shown in Figure 11.3.7 (EIAR Volume 3).

4.13 Estimating the Exposure

4.13.1 Following assessment of the potential peat slide Hazard, the potential impact and the consequences (i.e. Exposure) of the peat landslide has been assessed for both environmental exposure and infrastructure exposure.

4.13.2 The potential impact and the consequences of a peat slide to the environmental receptors are based on the likely environmental impact resulting from a peat slide.

4.13.3 When considering the potential impact of a peat failure, the presence of any existing structures (e.g. forestry tracks etc.), future development (i.e. proposed wind farm infrastructure components) and / or sensitive receptors (e.g. watercourses, designated sites etc.) were taken into account.

4.13.4 When considering the baseline condition (i.e. the Proposed Development prior to construction), where no receptors are present the impact is considered to be 'very low' (i.e. Exposure rating of 1). Where existing forestry tracks are present, an impact of 'very low' is also considered sufficient, due to the potential impact as a percentage of the total project cost likely to be less than 1% (i.e. Exposure rating of 1). Where infrastructure is located within 50m of a watercourse, the impact is raised to 'high' (i.e. Exposure rating of 3 – minor pollution incident may occur).

4.13.5 When considering the potential impact a peat failure could have on the Proposed Development, the following was considered. Where access tracks, compounds, small temporary quarries or met masts

are proposed, the impact is considered to be ‘very low’ (i.e. Exposure rating of 1 – e.g. minor remediation of infrastructure). At the site of a proposed turbine ‘low impact’ is considered more appropriate due to the increased impact on the cost of the Proposed Development (Exposure rating of 2 – i.e. 1% to 4% of the total project cost).

4.13.6 The potential impact and the consequences of a peat landslide to the infrastructure (turbines, access tracks etc.) and the peat habitat, otherwise defined as Exposure, were judged and the worst-case exposure scale for each location with regard to impact on the environment and infrastructure. This is presented in Table 14.

4.13.7 Table 14 presents the assessment in tabular form for each of the individual infrastructure components. For ease of assessment, the access track has been divided into 6 sections (AT1 to AT6), as shown on Figure 11.3.8 (EIAR Volume 2b).

4.13.8 Column 2 of Table 14 is to be cross-referenced with Table 3 and refers to the worst-case Hazard Scale value assigned to the infrastructure component. An example would be if a section of track passes through an area predominantly assessed as ‘Unlikely’ (2) on the Hazard Scale, but a very short section crosses through an area assessed as ‘Likely’, the entire section of track is given the worst-case Hazard Scale value of 3 (i.e. ‘Likely’). This is a highly conservative approach.

4.13.9 Column 3 of Table 14 relates to Table 4 and presents the Exposure related to the individual proposed infrastructure components.

4.13.10 Column 4 of Table 14 also related to Table 4 and presents the Exposure related to the environmental receptors.

4.13.11 Column 5 of Table 14 is to be cross-referenced with Table 5 and Table 6, and gives the worst-case Hazard Ranking (i.e. Hazard Ranking = Hazard Scale x Exposure Scale), whereby the value given in Column 2 (the Hazard) is multiplied by the higher value of the two Exposure ratings given in Columns 3 and 4 and expressed as a number. Again, this is a highly conservative approach.

4.13.12 Column 6 of Table 14 expresses the worst-case Hazard Ranking value as one of the following four terms, which are also shown in Table 6: High, Medium, Low or Negligible.

Table 14 Qualitative Assessment of Peat Landslide Hazard, Exposure and Baseline Hazard Ranking

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
Area	**Assessed Hazard (Worst Case)**	**Assessed Infrastructure Exposure**	**Assessed Environmental Exposure**	**Worst-Case Baseline Hazard Ranking**	**Worst-Case Baseline Hazard Ranking**	**Comment**
Turbine (T) (see Figure 11.3.7)						
T1	2	1	2	4	Negligible	
T2	3	2	2	6	Low	In an area of peat depth between 0 and 1.50m. Slope angle between 0- 10°
T3	3	1	1	3	Negligible	
T4	2	1	2	4	Negligible	
T5	2	2	2	4	Negligible	
T6	2	2	2	4	Negligible	
T7	2	2	3	6	Low	In an area of peat depth between 0m and 1.50m and an area of slope angle between 5.01° and 10.00°.
T8	2	2	2	4	Negligible	
T10	3	2	3	9	Low	In an area of peat depth between 0m and 1.00m and an area of slope angle between 5.01° and 10.01°.
T11	2	2	2	4	Negligible	
T13	1	2	2	2	Negligible	
T14	2	1	2	4	Negligible	
Access Track Sections (AT) (see Figures 11.3.7 and 11.3.8)						
AT1	2	3	2	6	Low	In an area of peat depth between 0m and 1.00m and an area of slope angle between 0° and 15.00°.
AT2	3	2	2	6	Low	In an area of peat depth between 0m and 1.00m and an area of slope angle between 0° and 20°.

Column 1 Area	Column 2 Assessed Hazard (Worst Case)	Column 3 Assessed Infrastructure Exposure	Column 4 Assessed Environmental Exposure	Column 5 Worst-Case Baseline Hazard Ranking	Column 6 Worst-Case Baseline Hazard Ranking	Column 7 Comment
AT3	2	3	2	6	Low	In an area of peat depth between 0m and 1.50m and an area of slope angle between 0° and 10°.
AT4	2	1	2	4	Negligible	
AT5	2	1	2	4	Negligible	
AT6	2	1	1	2	Negligible	
Borrow Pits (BP) (see Figure 11.3.7)						
BP01	3	2	2	6	Low	In an area of peat depth between 0m and 1.00m and an area of slope angle between 5.01° and 10°.
BP02	2	2	2	4	Negligible	
BP03	2	2	2	4	Negligible	
BP04	2	1	2	4	Negligible	
BP05	2	1	1	2	Negligible	
BP06	2	2	1	4	Negligible	
Additional Infrastructure (see Figure 11.3.7; EIAR Volume 3)						
Construction Compound	2	2	1	4	Negligible	
Substation	2	3	1	6	Low	In an area of peat depth between 0m and 1.00m and an area of slope angle between 5.01° and 10°.
Met Mast	1	3	1	3	Negligible	
Blade Laydown Area	2	2	1	4	Negligible	

4.13.13 The qualitative assessment has identified that the majority (9 No.) of the proposed turbine locations are located within ‘Negligible’ peat slide hazard areas. The remaining (3 No.) proposed turbine locations are located within ‘Unlikely’ peat slide hazard areas.

4.13.14 The vast majority of turbines T2 and T10 are located within an area of ‘Negligible’ peat slide hazard area. However, a small section of each location is located in an area of ‘Unlikely’ peat slide hazard, and in an attempt to provide a worst-case hazard they have been classed as such.

4.13.15 The overall worst-case baseline hazard rankings for the proposed turbine locations is ‘Low’ and this applies to T2, T7 and T10 due to the proximity of infrastructure and environmental exposure and the worst-case classing, discussed above.

4.13.16 Out of the six (6 No.) access track sections, five (AT1, AT3, AT4, AT5 and AT6) are located within ‘Unlikely’ peat slide hazard areas. The remaining track section (AT2) is located within a ‘Likely’ peat slide hazard area.

4.13.17 Due to the limited infrastructure and environmental exposure at AT4, AT5 and AT6, they have been classed as having a worst-case baseline hazard of ‘Negligible’.

4.13.18 AT1, AT2 and AT3 have all been classed as having a worst-case baseline hazard of ‘Low’ based on added infrastructure exposure and peat slide hazard.

4.13.19 The overall worst-case baseline hazard ranking for the access track sections are AT1 and AT3 which are classed as having a worst-case baseline hazard ranking of ‘Low’ due to infrastructure exposure.

4.13.20 BP02, BP03, BP04 and BP05 are all located in areas of ‘Negligible’ peat slide hazard and they all do not have infrastructure or environmental exposure greater than a ‘Low Impact’. This results in all these areas being classed as having a baseline hazard of ‘Negligible’.

4.13.21 BP01 is located in an area that is majority ‘Negligible’, however, a small section is located within ‘Likely’ peat slide hazard. Coupled with a ‘Low Impact’ infrastructure exposure, BP01 has been classed as having a baseline hazard of ‘Low’.

4.13.22 The overall worst-case baseline hazard ranking for the borrow pits is at BP01, which is classed as ‘Low’.

4.13.23 The construction compound, substation and mat mast are all located in areas of ‘Negligible’ or ‘Unlikely’ peat slide hazard.

4.13.24 The substation and met mast both have infrastructure exposure rankings of ‘High Impact’ and the construction compound has an exposure ranking of ‘Low Impact’. As such, coupled with the peat slide hazard, the construction compound and met mast are classed as having a worst-case baseline hazard ranking of ‘Insignificant’ while the substation has a ranking of ‘Low’.

4.13.25 The overall worst-case baseline hazard rankings for additional infrastructure is at the substation which has been classed as ‘Low’.

4.14 Estimating the Exposure

4.14.1 Due to the current severity of the baseline hazard ranking for some of the areas within the Development Site, a more detailed assessment for each component has been looked at prior to the mitigation measure. Table 15 shows the reassessment of the components that have a higher risk ranking than 'Negligible'.

4.14.2 In Table 15, the original scores are shown in brackets and explanations of the changes, if any, are in the comments column.

Table 15 Reassessment of Peat Landslide Hazard, Exposure and Baseline Hazard Ranking

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
Area	**Assessed Hazard (worst case)**	**Assessed Infrastructure Exposure**	**Assessed Environmental Exposure**	**Worst case Baseline Hazard Ranking**	**Worst Case Baseline Hazard Ranking**	**Comment**
T2	2(3)	(2)	(2)	4(6)	Negligible (Low)	Due to pixilation of Figure 11.3.7 (EIAR Volume 3), a small area of T2 is located over an area of 'Likely' PSAH. In reality the footprint of the infrastructure will likely be within the 'Unlikely' PSAH area, and as such the hazard has been reduced to 'Negligible'.
T7	(2)	(2)	(3)	(6)	(Low)	No Change
T10	2(3)	(1)	(2)	4(6)	Negligible (Low)	Due to pixilation of Figure 11.3.7 (EIAR Volume 3), a small area of T10 is located over an area of 'Likely' PSAH. In reality the footprint of the infrastructure will likely be within the 'Unlikely' PSAH area, and as such the hazard has been reduced to 'Negligible'.
AT1	(2)	2(3)	(2)	4(6)	Negligible (Low)	There is added infrastructure exposure due to AT1 being the main entrance to the Proposed Development.
AT2	2(3)	(2)	(2)	4(6)	Negligible (Low)	
AT3	2(2)	2(3)	2(2)	4(6)	Negligible (Low)	There is added infrastructure exposure due to AT3 being the main entrance to the Proposed Development. As shown in Figure 11.3.7 (EIAR Volume 3), this section of track is existing and has been used extensively for forestry purposes. As such, the infrastructure exposure has been reduced to 'Low Impact' as the impact of a slide in the areas around AT3 would be minimal.
BP01	2(3)	2(2)	2(2)	4(9)	Negligible (Low)	Due to pixilation of Figure 11.3.7 (EIAR Volume 3), a small area of BP01 is located over an area of 'Likely' PSAH. In reality the footprint of the infrastructure will likely be within the 'Unlikely' PSAH area, and as such the hazard has been reduced to 'Negligible'.
Substation	(2)	(3)	(1)	(6)	Low	No change

5. Mitigation Measures

5.1 General Principles

5.1.1 A Construction Management Statement (CMS) will be prepared incorporating good practice measures for the construction of wind farms in peatland environments. The CMS will be prepared in consultation with all relevant parties and in accordance with good practice.

5.1.2 A detailed ground investigation will be carried out prior to construction to inform detailed design and update the PLHRA which will follow the Best Practice Guidance.

5.2 Mitigation

5.2.1 Mitigation measures and good practice procedures are ultimately the responsibility of the construction Contractor. During the construction phase, these may include but are not limited to:

- Maintaining and updating a Geotechnical Risk Register throughout the works,
- Provision of a Geotechnical specialist on-site during the construction phase to undertake advance inspection, carry out regular monitoring and provide advice when required,
- Supervision of construction work by suitably qualified and experienced personnel,
- Identification of areas of deep peat, physical demarcation of such areas and instruction to site personnel to avoid these areas or minimise activities in these locations where practical,
- Micro-siting turbine bases, access tracks and other site infrastructure in order to avoid problem areas (subject to not violating other constraints),
- Identification of approved areas for stockpiling of any excavated rock or soils including peat,
- Side-casting of material during construction only in appropriate areas identified following risk assessment and agreed with all relevant parties (Environmental Clerk of Works / Geotechnical Clerk of Works, SEPA, SNH etc.),
- Avoid placing excavated material or other forms of loading on breaks of slope or other potentially unstable slopes,
- Any excavations in peat should be risk assessed and measures adopted to minimise the risk of failure within excavation side slopes and surrounding materials,
- Excavation of side slopes within peat should be as shallow an angle as possible and care should be taken to stabilise sides,
- The construction plant should minimise the extent and duration of open excavations and bare ground,
- Earthmoving activities should be restricted during and immediately after heavy and prolonged rainfall events,
- Establish / re-establish vegetation as soon as possible to improve slope stability and provide sediment transport control,

- Design and construction of a suitable drainage system for tracks and hardstandings that does not significantly affect the hydrological regime of the peat,
- Prevent artificial drainage from concentrated flows onto slopes or into excavations,
- Where deep peat excavations require dewatering, discharges of the pumped water will require to be controlled in a manner which does not adversely affect habitats on-site (due to potential silt content etc.) and does not lead to the creation of saturated, and hence very soft, areas of peat,
- Design of appropriate sediment control measures including the use of silt traps / barriers where necessary and cut-off ditches in particular at borrow pits and at appropriate locations along site tracks,
- Identification of drainage areas and areas of run-off which could potentially be affected by the development and appropriate stand-off distances established,
- Monitoring of slope and peat stability both in the vicinity and down slope of turbine / track areas during construction by suitably experienced and qualified personnel,
- Appropriate track construction methods to take cognisance of local topography, peat thickness and peat features (such as peat pipes, slumps, hags, etc.),
- Development of working methodologies that ensure that any exposed peat is protected to limit the potential for degradation, erosion or failure of the accumulation,
- Where excavated tracks are constructed, the peat and any soft soils should be removed and replaced with granular material placed in layers and compacted,
- Where floating tracks are constructed, a suitable geogrid and separator geotextile (where required) should be laid over the existing ground surface with graded stone (nominally 75mm down) placed over this in layers and compacted. However, a geotextile specialist should be sought regarding this,
- Any floating track design should take into account the properties of the peat soils at the site,
- Construction staff should be made aware of peat slide indicators and emergency procedures and
- Emergency procedures should include steps to be taken on detection of an incipient peat slide or of the event occurring.

5.2.2 Many of the measures provided above serve both to mitigate and recue the likelihood of a peat slide occurring as well as being good construction practice.

5.2.3 In line with the Scottish Government's (2017) *'Peat Landslide Hazard and Risk Assessments, Best Practice Guide for Proposed Electricity Generation Developments*', discussion of mitigation measures relevant to each potential peat landslide hazard identified is required.

5.2.4 A more detailed PLHRA will be required for the Proposed Development, which includes intrusive works to characterise the peat and which targets more sensitive areas, this will be undertaken post consent. Preliminary mitigation measures are recommended as follows:

- Infrastructure with an 'Insignificant' Baseline Hazard Ranking – ground conditions in these areas may be considered acceptable provided that all infrastructure and access roads are constructed in line with good practice guidelines which will be set out in the CMS. However, even in insignificant areas, additional intrusive works should be undertaken to assist in the overall characterisation of the peat, as well as for monitoring for signs of potential instability,
- Infrastructure with a 'Significant' Baseline Hazard Ranking – the primary mitigation measure employed will be avoidance of localised Significant Hazard areas by micro-siting, if appropriate,
- Infrastructure with a 'Significant' Baseline Hazard Ranking which cannot be avoided by micro-siting of infrastructure, additional peat thickness and characteristic information will be required by intrusive investigation and engineering measures may be required and should be considered during the ground investigation, detailed design and construction to minimise risks of triggering a peat landslide in the short term (during construction) or long term (during operation and decommissioning) such as:
  - Installation of drainage - Installation of targeted drainage would aim to isolate the areas of peat from upslope surface water. If applicable, re-routing surface (flushes/gullies) and subsurface (pipes) drainage around critical areas will also help control surface water,
  - Catch Fences – these should be installed down slope of areas of potential risk and are used to slow or halt run out from a landslide. These would typically be constructed into the peat substrate, and
  - Catch Ditches – these should be installed down slope of areas of potential risk and like catch wall fences are used to slow or halt run out. These would typically be constructed in non-peat material.

5.2.5 It is considered that such engineering measures would only be used as a last resort in localised areas where a particular hazard could not be avoided or dealt with adequately by other measures. A more detailed peat stability assessment and quantitative PLHRA is required following (post consent) ground investigation.

5.2.6 Construction Management – as part of the CMS best practice measures should be identified and followed during construction, these should include, but are not limited to:

- Specific work method statements to monitor compliance of activities in susceptible areas,
- Reviewing the weather forecast to prevent working in areas of peat during or immediately following heavy rainfall,
- Construction plant should be operated from the areas already constructed where practicable. Should there be no alternative to plant accessing areas of peat, low ground pressure equipment should be used,
- Spoil disposal areas (both peat and mineral soils) should be located where the risk of erosion, mass movement and water quality deterioration is minimal,
- Continual monitoring of groundwater and ground movement should be maintained,

- Drainage Measures – the installation of drainage measures such as soakaways and gullies (surface water) and pipes (subsurface water) can be used to re-route upslope surface water and groundwater around potential critical areas, and
- Localised Slope Re-profiling – this measure would only be recommended where environmental costs have been outweighed by the reduction in the Baseline Hazard Ranking.

5.2.7 As detailed in Table 15, there are various areas that have a potential Significant baseline hazard ranking. Table 16 sets out targeted preliminary mitigation measures recommended for each of the Significant areas within the Development Site.

Table 16 Targeted Mitigation for Each Development Area

Area	Worst Case Baseline Hazard Ranking	Mitigation
T7	Low	**Installation of Drainage** – Installation of targeted drainage around the northern and southern side of T1 would aim to isolate the areas of peat from upslope surface water. If applicable, re-routing surface (flushes/gullies) and subsurface (pipes) drainage around critical areas will also help control surface water. Drainage measures need to be carefully planned to minimise any negative impacts. **Monitoring** – A monitoring regime should be implemented to assess the increased risk of peat landslide over time. Where changes are noted, these should be identified immediately and actioned where necessary.
SS	Low	**Catch wall fences** - Installation of catch wall fences would help reduce and halt any peat slide, in turn reducing the exposure to the infrastructure (AT1). These would need to be engineered in such a way that they are adequately bounded into the bedrock and would be inspected periodically and, if required, debris moved.

5.3 Potential Peat Slide Indicators

5.3.1 During the site works (i.e. ground investigation works or construction), site staff should be made aware of the slop failure indicators, how to recognise them and the importance and mechanism for reporting them. They should also receive training and instruction in emergency procedures in the even of a peat slide. This will minimise the impact should a peat slide occur.

5.3.2 There are a number of recognised indicators for slope failures and these can indicate the potential of a peat slide event. The factors below are particularly applicable to low velocity events:

- The development of tension cracks across the slope or in semi-circular patterns showing progressive development,
- Boggy ground or new springs appearing at the base of slopes,
- Sudden reactivation / drying up of spring lines, drainage channels or streams,
- Creep and bulging of ground,
- Displacement and leaning of trees, fence posts, dykes etc., and,
- Breaking of underground services.

5.3.3 The suspected identification of any of these indicators should be drawn to the attention of site management and specialist geotechnical personnel immediately.

5.3.4 The information should be collected on site and updated regularly throughout the ground investigation to provide general information on the peat conditions and to assist in the assessment of peat stability.

6. Conclusion and Recommendations

6.1 Conclusions

6.1.1 AECOM's approach to infrastructure design has been to design the Proposed Development to avoid areas of peat deposits wherever possible.

6.1.2 As indicated in Figure 11.3.7 (EIAR Volume 3), the PSAH for the Development Site is generally assessed to be either 'Negligible' or 'Unlikely'. With the vast majority of the Proposed Development located in said areas, apart from T3 which is located in a small area of 'Likely' PSAH.

6.1.3 From the qualitative assessment (Table 14), 69% of the construction components within the Proposed Development were classed as having a hazard ranking of 'Negligible' and the remaining 31% classed as 'Low'.

6.1.4 Looking at these areas in more detail along with the peat probe results showed that the qualitative assessment is conservative in that is overestimated some of the higher risk areas. T2, AT2 and BP01 were initially classed as having a 'Likely' PSAH (Table 14) due to steeper sections of topography as shown in Figure 11.3.4 (EIAR Volume 3). However, these infrastructure components are close to existing infrastructure and the assessment likely picked up edges of the existing track and borrow pit thus creating a higher PSAH. T10 was classed as having a 'Likely' PSAH as well but upon further investigation it was assumed that pixilation in the figure lead to the classification.

6.1.5 As such, during the reassessment (Table15) the PSAH at these areas as downgraded to 'Negligible'. Together with the reassessment of the other components, the Proposed Development showed an overall classification of 'Negligible' across 92% of the Proposed Development and 8% classed as 'Low'. Figure 11.3.9 (EIAR Volume 3) presents the worst case hazard ranking across the Proposed Development.

6.1.6 The majority of the proposed infrastructure is located in areas assessed as having a Hazard Ranking of 'Negligible', meaning that the Proposed Development should proceed with monitoring and mitigation of peat landslide hazards in these locations as appropriate. However, as shown in Table 16, there are two components that have been assigned a Hazard Ranking of 'Low'. However, it is considered that even with the reassessment this is a relatively conservative approach.

6.1.7 A Hazard Ranking of 'Low' does not mean that the Proposed Development may not go ahead in these areas, but rather that further investigation is required to refine the assessment and mitigate the hazard through micro siting or re-design at these locations.

6.1.8 AECOM have outline targeted mitigation measures (Table 16) that could be implemented at each location. This goes some way to reducing the potential impact of a peat slide. However, it is advised that at a Stage II PLHRA is carried out, using additional information collected during the ground investigation, post consent.

6.1.9 The ground investigation should specifically target the areas along the proposed infrastructure locations identified in the reassessment as being 'Low' Hazard Rankings. However, the ground investigation should not be limited to said areas and information on the peat should be collected at all main infrastructure locations to allow for the peat to be better characterised.

6.1.10 The construction contractor will be required to produce a CMS for the construction of the Proposed Development, this should include the results of the Stage II PLHRA, which will be a further development of the preliminary PLHRA. The updated PLHRA will detail procedures and methods intended to be used by the construction contractor to minimise any environmental impact, including the risk of any peat slide events.

6.2 Recommendations

6.2.1 Areas identified above as having 'Low' Hazard Rankings should be further investigation through the provision of a Phase II PLHRA, post consent. The assessment will be refined, and any outstanding hazards will be mitigated by micro siting or through specific mitigation measures at the detailed design stage.

6.2.2 The updated PLHRA will be informed by a ground investigation that will provide sufficient information of peat characteristics across the Proposed Development. This will include laboratory testing of samples as set out in the Best Practice Guidance.

6.2.3 A CMS shall be prepared by the construction contractor incorporating good practice measures for the construction of wind farms in peatland environments, in consultation with relevant stakeholders, and in accordance with relevant good practice guidance.

7. References

- AECOM (2021). Environmental Impact Assessment: Chapter 11. Geology, Hydrology and Hydrogeology
- British Geological Survey (BGS) (2020). GeoIndex Viewer. Available: https://mapapps2.bgs.ac.uk/geoindex/home.html [Accessed: 26/08/20]
- Boylan N, Jennings P and Long M. (2008). Peat Slope Failure in Ireland, Quarterly Journal of Engineering Geology and Hydrogeology, February 2008 v. 41, No. 1, p. 93-108.
- Carling, P. (1986). Peat Slides in Teesdale and Weardale, Northern Pennines, July 1983: Description and Failure Mechanisms. Earth Surface Processes and Landforms, Vol. 11, pp. 193 - 206.
- Joint Nature Conservation Committee (JNCC). (2011). Towards an Assessment of the State of UK Peatlands, JNCC Report No. 445.
- Mills, A.J. (2002). Peat Slides: Morphology Mechanisms and Recovery, submitted for the degree of Doctor of Philosophy, University of Durham.
- National River Flow Archive (NRFA) (2020). Centre for Ecology & Hydrology. [Online]. Available: https://nrfa.ceh.ac.uk/ [Accessed: 24/08/20]
- Scotland's Environment (2021). Scotland's Environment Map. Available: Map | Scotland's environment web [Accessed 10/11/21].
- Scotland's Soils (2020). National Soil Map of Scotland. Available: https://soils.environment.gov.scot/maps/soil-maps/national-soil-map-of-scotland/ [Accessed 26/08/20]
- Scottish Government (2017). Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments. [Online]. Available: https://www.gov.scot/publications/peat-landslide-hazard-risk-assessments-best-practice-guide-proposed-electricity/ [Accessed: 01/09/20]
- Scottish Government, SNH and SEPA (2017) Peatland Survey. Guidance on Developments on Peatland, on-line version only. [Online]. Available: https://www.gov.scot/publications/peatland-survey-guidance/ [Accessed: 01/09/20]
- Scottish Renewables and SEPA (2012). Developments on Peatland: Guidance on the assessment of peat volumes, reuse of excavated peat and the minimisation of waste.
- Scottish Renewables, SNH, SEPA, FCS, HES and MSS (2019). Good Practice during Wind Farm Construction. [Online]. Available: https://www.nature.scot/guidance-good-practice-during-wind-farm-construction [Accessed: 01/09/20]
- SEPA (2010). Regulatory Position Statement – Developments on Peat.
- SNH (2015). Constructed Tracks in the Scottish Uplands [Online]. Available: https://www.nature.scot/sites/default/files/Publication%202015%20-%20Constructed%20tracks%20in%20the%20Scottish%20Uplands.pdf [Accessed: 01/10/20]

- SNH and FCS (2010). Floating Roads on Peat.
- Warburton, J., Holden, J. and Mills, A.J. (2004). Hydrological Controls of Superficial Mass Movements in Peat, in Earth Science Reviews 67 139 - 156.
- Wilson, P. & Hegarty, C. (1993). Morphology and Causes of Recent Peat Slides on Skerry Hill, Co. Antrim, Northern Ireland. Earth Surface Processes and Landforms, Vol. 18, pp. 593 - 601.

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Appendix 11.4: Carbon Balance Assessment

Appendix 11.4: Carbon Balance Assessment

1 Introduction

1.1.1 This Carbon Balance Assessment has been prepared to assess the carbon emission savings associated with the Proposed Development on peatlands within the Development Site.

1.1.2 It is widely recognised that wind farms and other renewable energy developments have the potential to save carbon emissions during their operational life when compared to traditional generation such as fossil fuel. One of the primary aims of any renewable energy development is to reduce carbon emissions by generation of carbon-free electricity. To achieve such savings, it is important to ensure that the management of peat resources does not adversely affect the carbon balance of renewable energy projects.

1.1.3 In Scotland, onshore wind farms are often built in upland areas due to the prevalence of wind resources. Peatland habitats are common in upland areas which inherently act as carbon stores, which if disturbed during construction of a development, have the potential to release carbon into the atmosphere.

1.1.4 A significant proportion of upland peat soils in the UK are situated in Scotland, which puts a responsibility on wind farm developers to ensure that their developments do not result in significant carbon losses.

1.1.5 Scottish Planning Policy (SPP) states within Paragraph 205 that "*where peat or other carbon rich soils are present, applicants should assess the likely effects of development on carbon dioxide (CO_2) emissions. Where peatland is drained or otherwise disturbed, there is liable to be a release of CO_2 to the atmosphere. Developments should aim to minimise this release*." (The Scottish Government, 2014).

1.1.6 The draft National Planning Framework 4 (NPF4) (Scottish Government, 2021), which when finalised and adopted will replace NPF3 and SPP, is similar to Paragraph 205 of SPP, although more detailed. Policy 33: Soils states that: "*c) Development on peatland, carbon rich soils and priority peatland habitat should not be supported unless essential for: … the generation of energy from a renewable source, where the proposal supports a zero carbon electricity system and will maximise the function of the peatland during its operational life and in decommissioning; or; … restoration of peatland. A detailed site specific assessment will be required to identify depth, quality and stability of soil and the effects of the development on peatland, including the likely effects of development on CO_2 emissions. This should inform careful project design and ensure that adverse impacts, including emissions release, can be avoided and minimised through siting, design and appropriate mitigation."*

2 Methodology

2.1.1 The potential releases of CO_2 during wind farm construction will be quantified and offset against the gains over the lifetime of the Proposed Development.

2.1.2 The latest Scottish Government Carbon Calculator for wind farms on Scottish peatlands (*Carbon Calculator Toll v1.6.1*) was used to estimate the carbon losses and gains from the Proposed Development. The tool takes into account a range of factors including wind farm characteristics, peat removal, alteration of drainage and site restoration. The calculator is accessed via the Scottish Government Website and the Carbon calculator for the Clachaig Glen Wind Farm can be viewed using reference **1TQ4-RTK0-58DQ v20**. The web-based version of the calculator supersedes all previous Microsoft Excel based versions of the tool. The methodology for the calculator is based on Nayak et al. (2010) '*Calculating carbon savings from wind farms on Scottish peat lands – A New Approach'*.

2.1.3 Supporting calculations are included in 'Carbon Balance Supporting Calculations' found at the end of this Appendix. The data sources used and a summary of the justifications for the selected values are detailed in Table 1 below.

2.1.4 It is important to note that the battery storage facility (up to 30 megawatts) which is a key component of the Proposed Development, has not been included within this assessment due to limitations with the carbon calculator. In addition, in order to present a worst-case scenario, the 56.2 hectare (ha) of peatland restoration proposed to be undertaken by the Applicant within the Development Site as part of the Proposed Development has also not been included within this assessment.

3 Main Assumptions

3.1.1 The following is a list of assumptions used within the carbon assessment:

- The peat within the Proposed Development is acid bog,
- The closest weather station (Ballypatrick) was used for temperature data on-site,
- Carbon emission factors used to calculate the carbon payback period are provided within the calculator and are based on the current Department for Business, Energy & Industrial Strategy Digest of UK Energy Statistics,
- The forestry required to be felled to accommodate the Proposed Development is 65.75 ha and it is assumed that there will be no replanting and the felled forestry will not be used for biomass,
- At this stage a Habitat Management Plan (HMP) has not be completed and will be prepared post consent. As such, worst-case scenarios have been assumed in the production of the calculator, as shown below in Table 1,
- There will be no measures to improve the carbon sequestration of the Proposed Development by raising water levels,
- There will be no cable trenches located on peaty areas that do not follow access tracks.

4 Inputs

4.1.1 Table 1 outlines the inputs to the Carbon Calculator and identifies the sources of information used alongside the justifications used.

Table 1 Carbon Balance Data Sources

Input	Expected Values	Minimum Values	Maximum Values	Source	Justification
No. of turbines	12	12	12	The Applicant	Site specific value
Lifetime of wind farm (years)	35	35	35	The Applicant	Site specific value
Power rating of turbines (turbine capacity) (MW)	5.0	4.2	6.6	The Applicant	Site specific value
Capacity factor (%)	39.5	37	42	The Applicant	Site specific value
Extra capacity required for backup (%)	5	5	5	Dale et al 2004, Energy Policy, 32, pg. 1949 - 56	Best available data
Additional emissions due to reduced thermal efficiency of the reserve generation (%)	10	10	10	Fixed	Fixed parameter
Type of peatland	Acid Bog	Acid Bog	Acid Bog	Peat Survey	Peat is likely blanket bog
Average air temperature at site (°C)	8.47	5.54	11.39	Met Office historic weather data for Ballypatrick	Nearest weather station
Average depth of peat at site (m)	1.14	0.91	1.37	Figure 11.4.1 Peat Excavation (EIAR Volume 3)	Average peat depth across site found during peat probing exercise (+/- 20% for max and min)
Carbon Content of dry peat (% by weight)	53.23	19.57	64.28	Scottish Soils Knowledge and Information Base (SSKIB)	SSKIB terms this a 'constant' across all sites.
Average extent of drainage around drainage features at site (m)	37.5	25.0	50.0	SEPA Correspond-ence	Previous SEPA guidance for similar projects
Average water table depth at site (m)	0.10	0.05	0.30	SEPA Correspond-ence	Generic values characteristic of peatlands before windfarm development

Input	Expected Values	Minimum Values	Maximum Values	Source	Justification
Dry soil bulk density ($g\ cm^{3}$)	0.13	0.07	0.29	Unpublished data from the National Soil Inventory of Scotland (2007 – 2009)	Assume it is decomposed peat as this gives worst case scenario
Time required for regeneration of bog plants after restoration (years)	30	30	30	Wind farm life, based on guidance from Renewable Foundation (Hall, 2006)	Best available data
Carbon accumulation due to Carbon fixation by bog plants in undrained peats ($tC\ ha^{-1}\ yr^{-1}$)	0.25	0.12	0.31	NatureScot guidance	Best available data
Area of forestry plantation to be felled (ha)	65.7	65.7	65.7	The Applicant	Site specific value
Average rate of carbon sequestration in timber (tC ha-1 yr-1)	3.6	3.6	3.6	NatureScot Guidance (Turunen *et al.*,)	Best available data
Coal-fired plant emission factor ($t\ CO_2\ MWh^{-1}$)	0.92	0.92	0.92	Fixed	Fixed parameter
Grid-mix emission factor ($t\ CO_2\ MWh^{-1}$)	0.25358	0.25358	0.25358	Fixed	Fixed parameter
Fossil fuel-mix emission factor ($t\ CO_2\ MWh^{-1}$)	0.45	0.45	0.45	Fixed	Fixed Parameter
Number of borrow pits	6	6	6	The Applicant	Site specific value
Average length of pits (m)	158.7	158.7	158.7	The Applicant	Site specific value
Average width of pits (m)	62.8	62.8	62.8	The Applicant	Site specific value
Average depth of peat removed from pit (m)	0.53	0.42	0.64	Figure 11.4.1 Peat Excavation (EIAR Volume 3)	Average peat depths underlaying infrastructure found during peat probing exercise (+/- 20% for max and min)
Diameter at bottom of turbine foundations (m)	25	25	25	The Applicant	Site Specific Value
Diameter at surface of turbine foundations (m)	10	10	10	The Applicant	Site Specific Value

Input	Expected Values	Minimum Values	Maximum Values	Source	Justification
Average depth of peat removed from turbine foundations (m)	0.49	0.39	0.59	The Applicant	Average peat depths underlaying infrastructure found during peat probing exercise (+/- 20% for max and min)
Average length of hard-standing (m) [Crane Pad]	40	40	40	The Applicant	Site Specific Value
Average width of hard-standing (m) [Crane Pad]	35	35	35	The Applicant	Site Specific Value
Average depth of peat removed from hard-standing (m)	0.57	0.46	0.68	Figure 11.4.1 Peat Excavation (EIAR Volume 3)	Average peat depths underlaying infrastructure, found during peat probing exercise (+/- 20% for max and min)
Total length of access track (m)	10,988	10,988	10,988	Site specific	Site specific value
Existing track length (m)	2,144	2,144	2,144	Site specific	Site specific value
Length of new access track that is floating road (m)	228	228	228	Site specific	Site specific value
Length of new access track that is excavated road (m)	8,616	8616	8616	Site Specific	Site Specific Value
Average depth of peat excavated for access track (m)	0.64	0.51	0.77	Figure 11.4.1 Peat Excavation (EIAR Volume 3)	Average peat depths underlaying infrastructure, found during peat probing exercise (+/- 20% for max and min)
Area of degraded bog to be improved (ha)	0	0	0	Worst Case Scenario	Site specific value
Area of borrow pits to be restored (ha)	6.21	6.21	6.21	Figure 11.4.1 Peat Excavation	Site specific value
Will you attempt to block any gullies that have formed due to the wind farm?	No	No	No	Worst Case Scenario	Site specific
Will you attempt to block all artificial ditches and facilitate rewetting?	No	No	No	Worst Case Scenario	Site specific

Input	Expected Values	Minimum Values	Maximum Values	Source	Justification
Will you control grazing on degraded areas?	No	No	No	Worst Case Scenario	Site specific
Will you manage areas to favour reintroduction of species?	No	No	No	Worst Case Scenario	Site specific

5 Results

5.1.1 As shown in Table 2, the expected total carbon payback time of the Proposed Development, based on the carbon losses, is 1.8 years compared with electricity generation from traditional sources such as fossil fuels. Table 2 also presents the findings for the minimum and maximum inputs from Table 1 and outputs from the Scottish Government's online carbon calculator.

Table 2 Carbon Balance and Pay Back Time

Criteria	Expected Values	Minimum Values	Maximum Values
Total Wind Farm CO_2 emission saving over fossil fuel mix of electricity generation (tCO_2 eq)	3,269,875	2,572,850	4,589,445
Net carbon emissions from Proposed Development (tCO_2 eq)	167,406	106,606	297,470
Total carbon savings over lifetime of the Proposed Development (tCO_2 eq)	3,102,469	2,466,244	4,291,975
Number of houses' carbon emissions offset by Wind Farm	50,756	40,347	70,215
Total payback time (years)	1.8	0.8	4.0
Percentage to payback time to wind farm lifespan (%)	5.14	2.29	11.4

5.1.2 Based on the expected scenario, the Proposed Development could prevent over 3,100,000 tonnes of CO_2 equivalent emissions (tCO_2 eg) being released into the atmosphere over the project's 35-year lifetime, compared to a fossil fuel mix of electricity generation. This is the equivalent of the emissions from 50,756 average houses over the 35-year lifetime of the Proposed Development (Department for Business, Energy & Industrial Strategy, 2021).

5.1.3 The Argyll and Bute Council area has an estimated 42,801 households based on National Record's '*Estimates of Households and Dwellings in Scotland, 2020*'. Therefore, the Proposed Development could offset the emissions from the fossil fuel mix supplied electricity to all the households in Argyll and Bute Council area.

5.1.4 As per the assumptions in Section 3, it should be noted that a replanting regime, the 56.2 ha of peatland restoration and the battery storage facility have not been included in the calculations and therefore the potential payback period may be better than identified above.

6 Conclusion

6.1.1 The calculation of carbon balance and payback has been based on the expected values where site specific data is available, and worst-case assumptions where it is not. It is therefore expected that the actual payback time of the Proposed Development will be less than currently estimated by the model. It is important to note that a replanting regime, the 56.2 ha of peatland restoration and the up to 30 MW battery storage facility have not been included in the calculations.

6.1.2 It is expected that the carbon loss due to the Proposed Development will be paid back in approximately 1.8 years, 5.14 % of the design life.

6.1.3 The Proposed Development is expected to provide a total carbon saving of over 3,100,000 tonnes over its lifetime, equivalent to the emissions from supplying fossil-fuel source electricity to 50,756 average homes.

6.1.4 Even considering the scenario with maximum values, the Proposed Development will have achieved carbon balance within 4 years (11.4 % of the design life) and, as such, will be beneficial to the Scottish Government's aspirations of carbon emission targets.

7 References

- Dale et al. (2004). Total cost estimates for large-scale wind scenarios in UK, Energy Policy, 32, pg 1949-56.
- Department for Business, Energy & Industrial Strategy (2018). The Renewables Obligation for 2020/21. [Online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/834055/renewable-obligation-calculating-level-2020-2021.pdf [Accessed: 29/09/20]
- Department of Energy and Climate Change (2017). Renewable electricity in Scotland, Wales, Northern Ireland and the regions of England in 2017
- Department for Business, Energy and Industrial strategy (2021). Digest of United Kingdom Energy Statistics: Annual Energy Data for UK, 2020.
- Hall. (2006) A guide to calculating the carbon dioxide debt and payback time for wind farms. Renewable Energy Foundation
- National Soil Inventory of Scotland (2007-2009). Unpublished data
- Nayak et al. (2008). Calculating carbon savings from wind farms on Scottish peat lands – a new approach, The Scottish Government
- Historical Weather Station Data - Ballypatrick. [Online]. Available at: https://www.metoffice.gov.uk/pub/data/weather/uk/climate/stationdata/ballypatrickdata.txt [Accessed: 23/09/20]
- National Records of Scotland (2021). Estimates of Households and Dwellings in Scotland, 2020. [Online]. Available at: Publication (nrscotland.gov.uk) [Accessed: 23/09/21]
- Scottish Government (2014) Scottish Planning Policy. [Online]. Available at: https://www.gov.scot/publications/scottish-planning-policy/documents/ [Accessed: 23/09/21]
- Scottish Government (2021) draft National Planning Framework 4. [Online]. Available at: https://www.gov.scot/publications/scotland-2045-fourth-national-planning-framework-draft/documents/ [Accessed: 24/01/22]
- Scottish Natural Heritage (2007). Annual Review 2006/07. Scottish Natural Heritage, Battleby. pp 36. Scottish Soils Knowledge and Information Base (SSKIB)
- Turunen, J., Pitkänen, A., Tahvanainen, T. and Tolonen, K. (2001). Carbon accumulation in West Siberian mires, Russia. Global Biogeochemical Cycles, 15, 285-296.

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- The aim of this section is to present the results of the Carbon Calculator in easy-to-understand terms for the Carbon Balance Non-Technical Summary
- Outputs include number of homes powered by wind farm and total carbon saving over lifetime of wind farm

Item	expected	min	max	Source
(1) Average house consumption (kWh/yr)	3,881.00	3,881.00	3,881.00	*Energy consumption in the UK 2021*
(2) Average house consumption (MW/yr)	3.88	3.88	3.88	
(3) The CO2 emissions (Fossil-mix) (kg / kWh)	0.45	0.45	0.45	*Fixed in the Online calculator*
(4) Total annual CO2 emissions (kgCO2 / house)	1,746.45	1,746.45	1,746.45	= (1) x (3)
(4b) Emissions from house fossil-fuel mix over lifetime of windfarm(kgCO2 / house)	61,125.75	61,125.75	61,125.75	= (4)*(6)
(5) Energy output from windfarm over lifetime (MWh)	7,266,420.00	5,717,477.00	10,198,742.00	*Carbon Calculator / Payback Time and CO2 emissions tab / Energy Output from Windfarm over lifetime*
(5a)Energy output per year (MWh)	207,612.00	163,356.49	291,392.63	= (5) / (6)
(6) Design life (yrs)	35.00	35.00	35.00	
(7) Payback time (yrs)	1.8	0.8	4.0	*Carbon Calculator / Payback Time and CO2 emissions tab / Carbon Payback Time fossil-mix*
(8) Payback time (months)	21.6	9.6	48.0	= (7) * 12
% to payback time of life time	5.1	2.3	11.4	
(9) CO2 emissions saving from fossil mix (tCO2/yr)	93,425.00	73,510.00	131,127.00	*Carbon Calculator / "Payback Time and CO2 emissions" / "1. Windfarm CO2 emission saving over fossil-mix"*
(10) Total emissions from fossil fuels over lifetime (tCO2)	3,269,875.00	2,572,850.00	4,589,445.00	= (6) x (9)
(11) CO2 emissions from development (tCO2eq)	167,406.00	106,606.00	297,470.00	*Carbon Calculator / "Payback Time and CO2 emissions" / "Net emissions of carbon dioxide"*
(12) CO2 savings (tCO2)	3,102,469.00	2,466,244.00	4,291,975.00	= (10) - (11)
(13) Average annual CO2 savings (tCO2/yr)	88,641.97	70,464.11	122,627.86	= (12) / (6)
(14) No. of houses powered over lifetime	53,494	42,091	75,082	= (5a) / (2)
(16) Number of houses' carbon emissions offset by wind farm	50,756	40,347	70,215	(12) / (4b/1000)
No. Houses in Argyll and Bute	42,801	42,801	42,801	Estimates of Households and Dwellings in Scotland, 2020 | National Records of Scotland (nrscotland.gov.uk)
Percentage of emissions offset from Wind Farm	119%	94%	164%	

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Appendix 11.5: End User Private Water Supply Questionnaire

Appendix 11.5: End User Private Water Supply Questionnaire

1 Introduction

1.1.1 Questionnaires were sent out on 04/09/2020 to 51 properties located within 1km of the Development Site boundary to confirm whether the properties used a private water supply (PWS). This buffer was chosen to ensure the buffers from the Scottish Environment Protection Agency's (SEPA, 2017) '*Land Use Planning System – Guidance Note 4*', were captured. This states that road tracks and trenches should not be within 100m of the source of a PWS and small temporary quarries, and foundations within 250m.

1.1.2 Of the 51 properties contacted, six responded and only two of them indicated that a PWS was present. The two responses where PWS were identified as being present are shown in Table 1.

1.1.3 One of the remaining four questionnaire respondents confirmed that their property, 30 Cara View, and all others on that street – accounting for 8 properties in total - were on mains supply. This response is detailed in Table 2, alongside the other three non-PWS responses.

1.1.4 Table 3 lists those properties where a questionnaire was sent, but no response was received. Those properties identified by the response from 30 Cara View are highlighted within this table.

Table 1. PWS Questionnaire Response: PWS Present

Question	Response 1	Response 2
Property Contacted	South Beachmore Farm, Muasdale, Argyll and Bute, Scotland, PA29 6XD, United Kingdom	Ron Mara, North Beachmore, Muasdale, Argyll and Bute, Scotland, PA29 6XD, United Kingdom
Water Supply	Private Supply	Private Supply
Age of Supply	~75 years	10 years
Responsible Party	Resident	Sloan Builders Ltd, Lochview, Whitehouse, Tarbert PA29 6XR
1. Source Type 2. Source Name 3. Source NGR	1. Stream 2. Unknown 3. Not provided (approx. location)	1. Borehole 2. Unknown 3. Not provided (approx. location)
Approx Borehole Depth (m) if applicable	N/A	~70
Geological Strata	No answer	Loch Tay Limestone
Distributed via	Pipe to holding tank	Field
How PWS is used	Drinking water, washing, cattle	Drinking water, washing, grey water
1. No persons supplied for domestic 2. No dwellings served 3. Average daily water abstracted (m3/day)	1. 1 2. 1 3. Unknown	1. 7 2. 3 3. Unknown
How often is water abstracted from PWS?	Daily	Daily
Abstraction Licence from SEPA?	No	Speak to Sloan Builders
Does supply run out during dry periods?	Can fluctuate, but does not run dry	No
Any forecasted changes to usage?	No	No
Quality of PWS	No complaint	Very good. Treated for calcium carbonate
Has water analysis ever been undertaken?	No	Yes – Speak to Sloan Builders
Are you likely to start using a PWS within the next few years?	Content with what I've got	-

Table 2. PWS Questionnaire Response: No PWS Present

Property Contacted	Response
30 Cara View, Tayinloan, Argyll and Bute, Scotland, PA29 6XJ, United Kingdom	Mains Supply "*Cara View is a council estate and therefore on public water supply. Although some houses are privately owned (inc. mine) none are on private water supply*"
High Crubasdale Farm, Muasdale, Argyll and Bute, Scotland, PA29 6XD, United Kingdom	Mains Supply
North Craigruadh, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	Mains Supply
North Crubasdale Farm, Muasdale, Argyll and Bute, Scotland, PA29 6XD, United Kingdom	Mains Supply

Table 3. PWS Questionnaire Response: No Response

Property Contacted	Further Detail
25 Cara View, Tayinloan, Argyll and Bute, Scotland, PA29 6XJ, United Kingdom	Mains Supply (referencing comment from 30 Cara View resident in Table 2)
26 Cara View, Tayinloan, Argyll and Bute, Scotland, PA29 6XJ, United Kingdom	
27 Cara View, Tayinloan, Argyll and Bute, Scotland, PA29 6XJ, United Kingdom	
28 Cara View, Tayinloan, Argyll and Bute, Scotland, PA29 6XJ, United Kingdom	
29 Cara View, Tayinloan, Argyll and Bute, Scotland, PA29 6XJ, United Kingdom	
31 Cara View, Tayinloan, Argyll and Bute, Scotland, PA29 6XJ, United Kingdom	
32 Cara View, Tayinloan, Argyll and Bute, Scotland, PA29 6XJ, United Kingdom	
Culfuar, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	Address inaccessible
Tayintruan, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No such address
North Beachmore House, Muasdale, Argyll and Bute, Scotland, PA29 6XD, United Kingdom	No reply
Jura, Killean, Killean Estate Road, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Islay, Killean, Killean Estate Road, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
The Shepherds Cottage, Killean Estate, Killean Estate Road, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Arran, Killean Estate, Killean Estate Road, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply

Property Contacted	Further Detail
Faodail, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Killean, Killean Estate, Killean Estate Road, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Fox-Glove, Drumnamucklach, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Killean Dairy House, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Butter-Cup, Drumnamucklach, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Boatmans Cottage, Killean Estate, Killean Estate Road, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
The Dolls House, Killean Estate, Killean Estate Road, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Thistle, Drumnamucklach, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Killean Lodge, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Rosemary, Drumnamucklach, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
The Villa Des Beaux Arts, Killean Estate, Killean Estate Road, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Heather, Drumnamucklach, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Honeysuckle, Drumnamucklach, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Keepers Cottage, Killean Estate, Killean Estate Road, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Old Mission Cottage, Killean Estate, Killean Estate Road, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Bracken, Drumnamucklach, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Blae-Berry, Drumnamucklach, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Hare-Bell, Drumnamucklach, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Gigha, Killean Estate, Killean Estate Road, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
North Beachmore Restaurant, Muasdale, Argyll and Bute, Scotland, PA29 6XD, United Kingdom	No reply
High Clachaig, Muasdale, Argyll and Bute, Scotland, PA29 6XD, United Kingdom	No reply
No 3 Dolls Houses, Killean, Killean Estate Road, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply

Property Contacted	Further Detail
Killean Farm, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Caravan, Killean, Killean Estate Road, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Low Clachaig Farm, Muasdale, Argyll and Bute, Scotland, PA29 6XD, United Kingdom	No reply
Drumnamucklach Cottage, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Killean House, Killean Estate Road, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Kilmory, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
The Old Restaurant, North Beachmore Cottage, Muasdale, Argyll and Bute, Scotland, PA29 6XD, United Kingdom	No reply
Primrose, Drumnamucklach, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply
Cruachan, Tayinloan, Argyll and Bute, Scotland, PA29 6XF, United Kingdom	No reply

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Appendix 11.6: Existing Controlled Activities Regulations (CAR) Licenses

Appendix 11.6 Existing Controlled Activities Regulations (CAR) Licenses

Table 1 Existing CAR Licenses within 2km of the Development Site

License Number	Location (NGR)	Activity	Address
CAR/L/1034360	NR 7036 4480	Abstraction Hydropower	KILLEAN ESTATE HYDRO PROJECT, KILLEAN ESTATE, TAYINLOAN, ARGYLL PA29 6XF
CAR/L/1034360	NR 7034 4479	Impoundment Hydropower	KILLEAN ESTATE HYDRO PROJECT, KILLEAN ESTATE, TAYINLOAN, ARGYLL PA29 6XF
CAR/L/1034360	NR 6958 4458	Abstraction Return	KILLEAN ESTATE HYDRO PROJECT, KILLEAN ESTATE, TAYINLOAN, ARGYLL PA29 6XF
CAR/R/1020251	NR 6896 4334	Sewage (Private) Secondary	Land North of Tighchromain Cottage, (2 PROPERTIES), Tayinloan
CAR/R/1021872	NR 6888 4200	Sewage (Private) Primary	Plot 2, North Beachmore, Muasdale, Tarbert PA29 6XD
CAR/R/1037795	NR 68122 40829	Sewage (Private) Primary	Seafield, Muasdale, Tarbert PA29 6XD
CAR/R/1053119	NR 6931 4321	Sewage (Private) Primary	Beachar, Tayinloan, Tarbert PA29 6XF
CAR/R/1055950	NR 6807 4054	Sewage (Private) Primary	STACAN NA MARA, MUASDALE, TARBERT PA29 6XD
CAR/R/1062005	NR 6854 4178	Sewage (Private) Secondary	NEW HOUSE, LAND WEST OF NORTH BEACHMORE FARM, MUASDALE, ARGYLL
CAR/R/1063102	NR 6816 4136	Sewage (Private) Primary	Shore Cottage, Muasdale, Tarbert PA29 6XD
CAR/R/1073677	NR 68037 40421	Sewage (Private) Primary	DUNFERMIN, MUASDALE, TARBERT PA29 6XD
CAR/R/1077986	NR 68672 40422	Sewage (Private) Primary	LOW CRUBASDALE FARM, MUASDALE, TARBERT PA29 6XD
CAR/R/1078151	NR 67950 40460	Sewage (Private) Primary	BANNOCHY, MUASDALE, TARBERT PA29 6XD
CAR/R/1078739	NR 68820 42670	Sewage (Private) Primary	ACHABHEAG, TAYINLOAN, TARBERT PA29 6XF
CAR/R/1092923	NR 6986 3986	Sewage (Private) Primary	Ashdale, Muasdale, TARBERT PA29 6XD
CAR/R/1093846	NR 6852 4175	Bridging Culvert	Lochview, Whitehouse, TARBERT PA29 6XR
CAR/R/1100259	NR 6800 4024	Sewage (Private) Primary	Crubasdale, Muasdale, TARBERT PA29 6XD
CAR/R/1105672	NR 6919 4371	Sewage (Private) Primary	Drumnamucklach Cottage, Tayinloan
CAR/R/1105684	NR 7122 4155	Bridge	Achaglas, High Clachaig, West Argyll forest District
CAR/R/1107047	NR 6800 4020	Sewage (Private) Primary	Bridge House, Muasdale, TARBERT PA29 6XD
CAR/R/1117889	NR 6893 4194	Sewage (Private) Primary	North Beachmore, Muasdale, TARBERT PA29 6XD
CAR/R/1120247	NR 7498 4436	Bridging Culvert	Deucheran Forest, Near Killean Village
CAR/R/1139716	NR 6894 4374	Sewage (Private) Primary	Craigruadh Farm, Tayinloan, TARBERT PA29 6XF
CAR/R/1144010	NR 69551 44674	Sewage (Private) Primary	Dolls House 1, 2 & 3, Killean Estate, Tayinloan, Tarbert PA29 6XF
CAR/R/1144011	NR 69944 44464	Sewage (Private) Primary	Stable Flats 1, 2 & 3, Killean Estate, Tayinloan, Tarbert PA29 6XF
CAR/R/1144012	NR 69579 44499	Sewage (Private) Primary	The Villa, Killean Estate, Tayinloan, Tarbert PA29 6XF
CAR/R/1144013	NR 69563 44436	Sewage (Private) Primary	The Shepherd's Cottage, Killean Est, Tayinloan, Tarbert PA29 6XF
CAR/R/1144014	NR 69558 44468	Sewage (Private) Primary	Killean Dairy House, Tayinloan, TARBERT PA29 6XF
CAR/R/1144016	NR 69520 44411	Sewage (Private) Primary	Gate Lodge, Killean Estate, Tayinloan, Tarbert PA29 6XF
CAR/R/1144017	NR 69825 44408	Sewage (Private) Primary	The Gardener's Cottage, Killean Est, Tayinloan, Tarbert PA29 6XF
CAR/R/1144018	NR 69659 44313	Sewage (Private) Primary	Killean House, Tayinloan, Tarbert PA29 6XF
CAR/R/1151106	NR 69151 43719	Sewage (Private) Primary	Plot A, Site North of Craigruadh Farm,, Tayinloan, Argyll PA29 6XF
CAR/R/1156863	NR 69080 43570	Sewage (Private) Primary	Plot B, Site South of Craigruadh Farm, Tayinloan PA29 6XF
CAR/R/1165587	NR 68924 42015	Sewage (Private) Primary	North Beachmore Cottage, The Old Restaurant, Muasdale, Argyll PA29 6XD
CAR/R/1166612	NR 68947 41996	Sewage (Private) Primary	North Beachmore Farmhouse, Muasdale, Tarbert PA29 6XD

License Number	Location (NGR)	Activity	Address
CAR/R/1169407	NR 69193 43813	Sewage (Private) Primary	Plot, North of North Craigruadh, by Tayinloan, Argyll PA29 6XF
CAR/S/1018243	NR 6908 4065	Sheep Dip onto Land	HIGH CRUBASDALE, MUASDALE, TARBERT, ARGYLL PA29 6XD
CAR/S/1020382	NR 6792 4024	Sewage (Public) Combined Sewer Overflow	MUASDALE SEPTIC TANK, UNOCCUPIED LAND, OFF A83, MUASDALE, ARGYLL PA29 6XE
CAR/S/1020382	NR 6792 4024	Sewage (Public) Primary	MUASDALE SEPTIC TANK, UNOCCUPIED LAND, OFF A83, MUASDALE, ARGYLL PA29 6XE
CAR/S/1108739	NR 6879 4287	Bridging Culvert	A83 Beachmeanach Bridge Repairs, A83, Nr Killean, Argyll
CAR/S/1108739	NR 6879 4287	Realignment	A83 Beachmeanach Bridge Repairs, A83, Nr Killean, Argyll
CAR/S/1188654	NR 6807 3985	Sheep Dip onto Land	North Muasdale Farm, Tarbert, Argyll PA29 6XD
CAR/L/1000369	NR 6940 4600	Sewage (Public) Primary	Tayinloan Sewage Treatment Works, Unknown
CAR/R/1020252	NR 6958 4599	Sewage (Private) Primary	NEW HOUSE ON, LAND EAST OF BROOKFIELD COTTAGE, Tayinloan
CAR/R/1023039	NR 6973 4597	Sewage (Private) Primary	FERRY COTTAGE, TAYINLOAN, TARBERT PA29 6XQ
CAR/R/1049749	NR 6983 4605	Sewage (Private) Primary	Achintien, Tayinloan, Tarbert PA29 6XG
CAR/R/1064867	NR 6933 4646	Sewage (Private) Primary	Cladach Bothan, Ferry Road, Tarbert PA29 6XQ
CAR/R/1071351	NR 69921 46066	Sewage (Private) Primary	KYLE GIGHA, TAYINLOAN, ARGYLL PA29 6XG
CAR/R/1071372	NR 69997 46086	Sewage (Private) Primary	FORRESTER'S HOUSE, TAYINLOAN, TARBET, ARGYLL PA29 6XG
CAR/R/1071651	NR 69634 46005	Sewage (Private) Primary	BURNSIDE, TAYINLOAN, TARBERT PA29 6XQ
CAR/R/1114963	NR 7028 4620	Bridge	Largie Woodlands, LARGIE ESTATE
CAR/R/1116700	NR 6988 4614	Sewage (Private) Primary	Tayinloan, Tarbert PA29 6XG
CAR/R/1124714	NR 6936 4641	Sewage (Private) Primary	Site South of 'Cladach Bothan', Ferry Road, Tayinloan PA29 6XQ
CAR/R/1143502	NR 70130 46069	Sewage (Private) Primary	Colt House, Tayinloan, Tarbert PA29 6XG
CAR/R/1144015	NR 69981 46829	Sewage (Private) Primary	Dalmore Farm House, Killean Estate, Tayinloan, Tarbert PA29 6XF
CAR/R/1187314	NR 69724 45950	Sewage (Private) Primary	Bridge Cottage & Smiddy House, Tayinloan, Argyll PA29 6XG
CAR/S/1020309	NR 6929 4665	Sewage (Private) Primary	FERRY FARM, FERRY ROAD, TAYINLOAN, TARBERT PA29 6XQ

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Appendix 11.7: Peat Balance

Appendix 11.7: Peat Balance

1 Introduction

1.1.1 This Appendix has been prepared in accordance with the guidance: Scottish Renewables (SR) & Scottish Environment Protection Agency (SEPA) (January 2012) '*Developments on Peatlands, Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste*', from herein referred to as '**SR & SEPA (2012)**.'

1.1.2 The peat balance calculations within this Appendix are based on the construction of the components of the Proposed Development that could generate peat excavation. However, the calculations do not account for other factors, namely the 56.2 hectares of peatland restoration proposed as part of the Proposed Development within the Development Site. This is excluded in order that the peat balance calculations show the worst-case scenario.

2 Acrotelmic and Catotelmic Layers

2.1.1 Scottish Government, Scottish Natural Heritage (now NatureScot) and SEPA (2017) '*Peatland Survey: Guidance on Developments on Peatland*' (online version only) states the acrotelm layer, the surface layer of a peatland within which all living vegetation exists, is usually less than 300 millimetres (mm) thick but may be up to 500 mm.

2.1.2 Therefore, in the absence of detailed peat characteristics within the Development Site, it has been assumed the acrotelm layer is 450 mm thick.

2.1.3 The depth underlaying the acrotelm layer is therefore assumed to be the catotelm layer (>450mm) and is assumed to be the remaining section of the measured peat depth.

2.1.4 Table 1 details the construction activities for the Proposed Development that could generate peat excavation and the approximate associated volumes.

2.1.5 It is anticipated that all the 106,351 m³ of peat would be excavated, of which 47,858 m³ would be acrotelm and 58,493 m³ would be catotelm.

2.1.6 The peat re-use has been calculated in accordance with SR & SEPA (2012), the breakdown of which is shown below in Table 2.

Table 1 Peat Excavation Volumes

Infrastructure Type	Total Area (m²)	Total Peat Volume (m³)	Estimated Acrotelm Excavation Volume (m³)	Estimated Catotelm Excavation Volume (m³)
Access Track	68,549	43,004	19,352	23,652
Borrow Pit	62,067	33,939	15,273	18,666
Construction Compound	10,025	5,745	2,585	3,160
Turbine Foundation	5,890	2,922	1,315	1,607
Turbine Crane pad	24,339	12,407	5,583	6,824
Substation	5,000	3,175	1,429	1,746
Permanent Met Mast and Crane pad	404	95	43	52
Total peat to be excavated (m³)		101,287	45,579	55,708
Total peat + 5% (m³)		106,351	47,858	58,493

Table 2 Peat Re-use Volumes

Location	Length (m)	Width of Peat (m)	Depth of Peat (m)	Cross-sectional Area of Peat (m²)	Plan Area of Peat (m²)	Quantity	Volume of Acrotelmic Peat Re-Used (m³)	Volume of Acrotelmic Peat Re-Used (m³)	Reason for Re-Use
Excavated track verges	5,445.50	1.60	0.54	0.86	n/a	2	9,409.82	-	Required to create a bund to prevent natural run-off mixing with track run off. Required throughout the site on both sides of the track, providing cable protection and tying the access track into landscape.

Location	Length (m)	Width of Peat (m)	Depth of Peat (m)	Cross-sectional Area of Peat (m²)	Plan Area of Peat (m²)	Quantity	Volume of Acrotelmic Peat Re-Used (m³)	Volume of Acrotelmic Peat Re-Used (m³)	Reason for Re-Use
Floating Track Verges	267.00	1.60	0.55	0.88	n/a	2	469.92	-	Required to tie the access tracks into the landscape, encouraging vegetation re-growth in keeping with the surrounding habitat and providing cable protection.
Transition from floating road to excavated road	30.00	1.60	0.55	0.88	n/a	2	52.80	-	Required to create a gradual change in stiffness of road construction from floating road to excavated road.
Above turbine foundations	n/a	n/a	0.55	n/a	490.87	12	2,945.22	-	Required to restore the natural habitat and to encourage vegetation re-growth in keeping with the surrounding landscape.
Crane pad verges	266.00	1.60	0.55	0.88	n/a	12	2,808.96	-	Required to tie the raised crane pad sides into the landscape and to encourage vegetation re-growth in keeping with the surrounding habitat.
Small temporary quarries (Borrow pits) restoration	249.13	249.13	0.52	n/a	62,067.00	1	32,274.84	-	Used to reinstate borrow pits profile to a comparative level with gentle slopes which blend in with the surrounding landscape. Also, to encourage vegetation re-growth.
Borrow pits restoration	n/a	n/a	0.942	n/a	62,067.00	1	-	58,467.11	Used to reinstate borrow pits profile to a comparative level with gentle slopes which blend in with the surrounding landscape. Also to encourage vegetation re-growth.

3 Summary

3.1.1 Table 3 shows the peat balance for the Proposed Development. It is anticipated that 106,429 m³ of peat can be re-used within the Development Site, with a waste of - 77 m³ which represents approximately 0.07 % and therefore should be considered insignificant.

3.1.2 Where a negative surplus is shown, i.e. excavated volume is less than the re-use volume, the reuse volume depth will be reduced accordingly, in line with the volume of available material.

3.1.3 Measures for the recycling, other recovery and disposal of waste peat are not required to be included.

Table 3 Peat Re-Use Volumes

Infrastructure Type	Volume of Acrotelmic Peat (m³)	Volume of Catotelmic Peat (m³)	Total (m³)
Excavated	47,858	58,493	106,351
Re-Used	47,962	58,467	106,429
Waste	-103	26	-77

3.1.4 These peat balance calculations also do not account for other factors, namely the 56.2 hectares of peatland restoration proposed as part of the Proposed Development within the Development Site. This is excluded in order that the peat balance calculations show the worst-case scenario.

4 References

- Scottish Renewables & the Scottish Environment Protection Agency (January 2012) ‘Developments on Peatlands, Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste’,
- Scottish Government, Scottish Natural Heritage & the Scottish Environment Protection Agency (2017) Peatland Survey. Guidance on Developments on Peatland, on-line version only.

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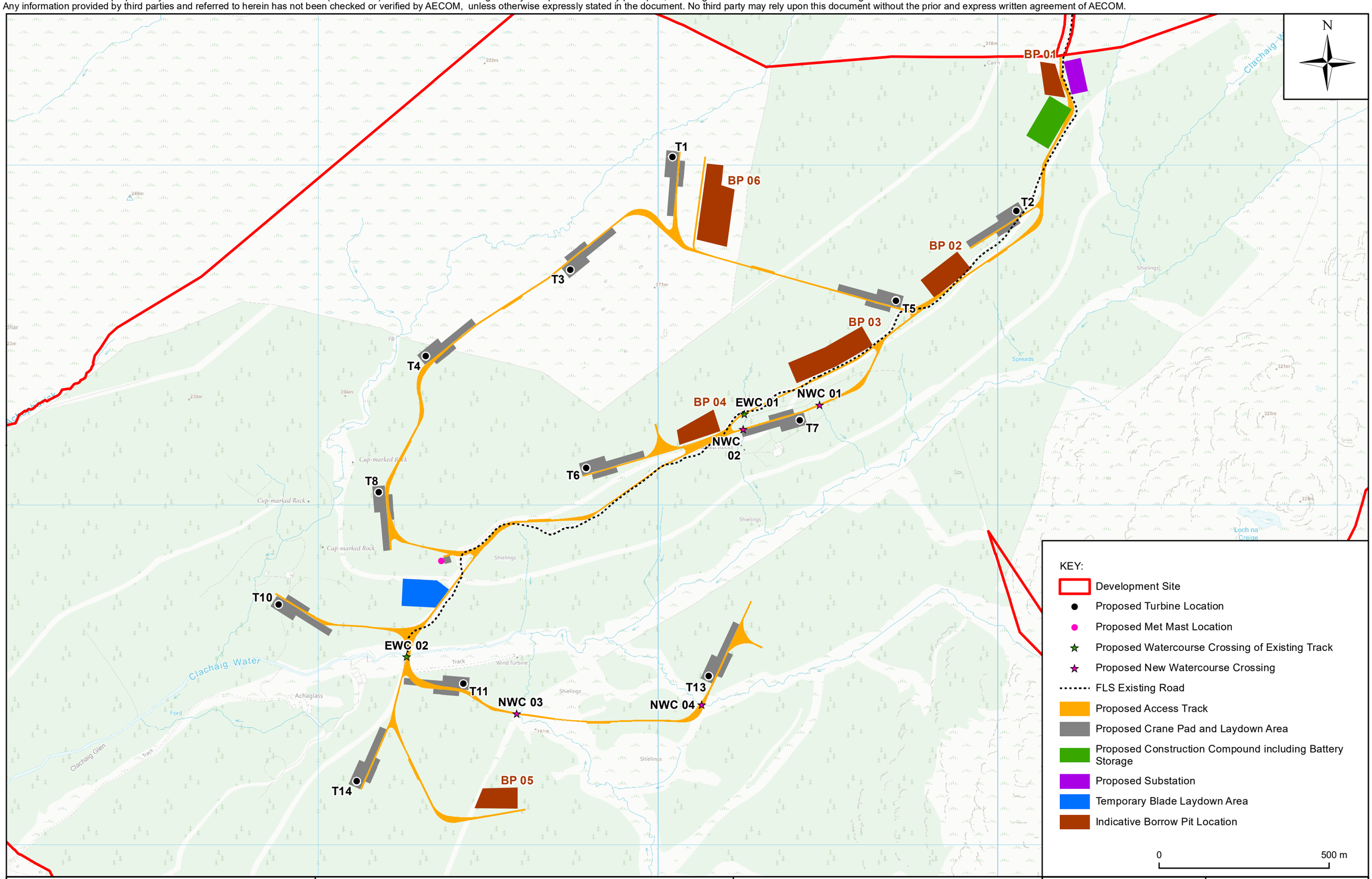
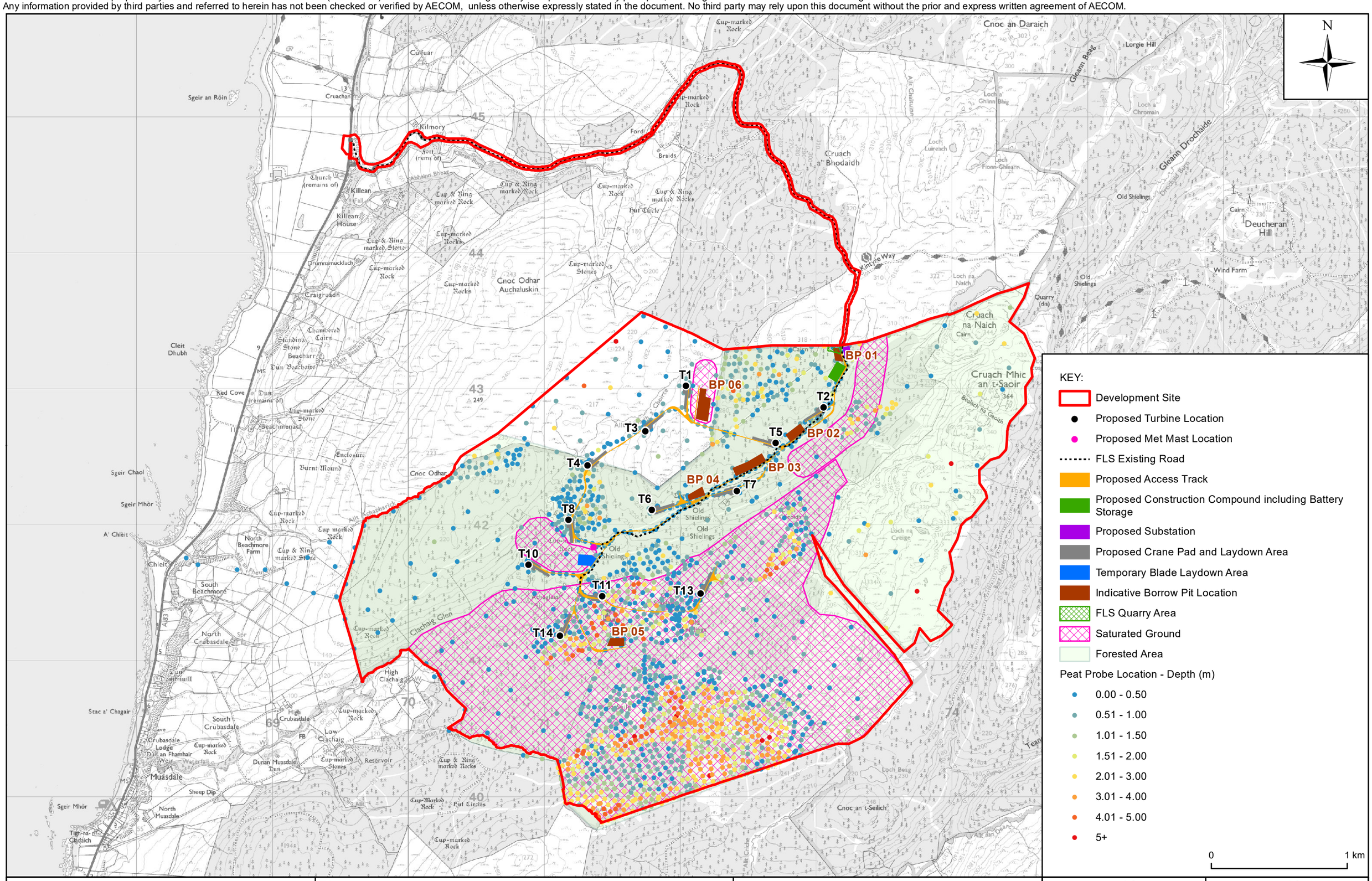
EIAR Technical Appendices Figures

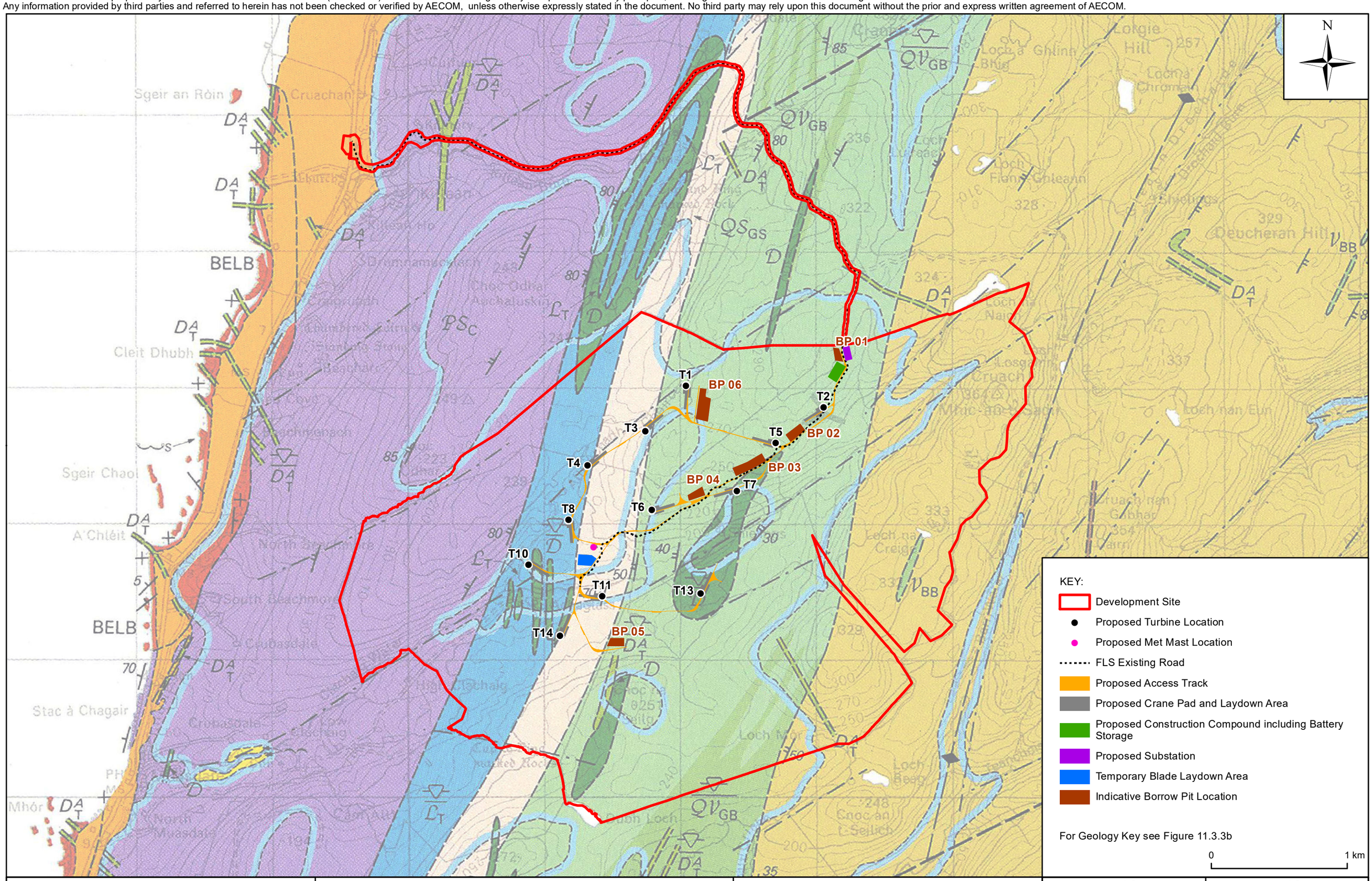
Figures: 11.3.1; 11.3.2; 11.3.3a; 11.3.3b



Client: RWE	Title: FIGURE 11.3.1 PROPOSED WIND FARM LAYOUT	AECOM One Trinity Gardens Quayside Newcastle, NE1 2HF Tel +44 (0) 191 224 6500 Fax +44 (0) 191 224 6599 www.aecom.com	Drawn: LC	Checked: AR
Project: CLACHAIG GLEN WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT			Verified: DL	Approved: SW
			Date: JANUARY 2022	Scale at A3: 1:10,000
			Drawing Number: CG_220106_EIA_A11.3.1_v2	A3



Client: RWE	Title: FIGURE 11.3.2 SITE VISIT FEATURES	AECOM One Trinity Gardens Quayside Newcastle, NE1 2HF Tel +44 (0) 191 224 6500 Fax +44 (0) 191 224 6599 www.aecom.com	Drawn: LC / Checked: AC
Project: CLACHAIG GLEN WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT			Verified: DL / Approved: SW
			Date: JANUARY 2022 / Scale at A3: 1:25,000
			Drawing Number: CG_220106_EIA_A11.3.2_v3 / A3



Client: RWE	Title: FIGURE 11.3.3a GEOLOGY	AECOM One Trinity Gardens Quayside Newcastle, NE1 2HF Tel +44 (0) 191 224 6500 Fax +44 (0) 191 224 6599 www.aecom.com	Drawn: LC / Checked: AC
Project: CLACHAIG GLEN WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT			Verified: DL / Approved: SW
			Date: JANUARY 2022 / Scale at A3: 1:25,000
			Drawing Number: CG_220106_EIA_A11.3.3a_v2 / A3

SUPERFICIAL DEPOSITS

FLANDRIAN

- Blown Sand
- Peat
- Alluvium
- River Terrace Deposits, undifferentiated
- Shore Face and Marine Deposits
- Raised Marine Deposits, undifferentiated

LATE DEVENSIAN

- Till

SEDIMENTARY ROCKS

? PERMIAN

- BELB — **Bellochantuy Bay Formation:** Bright red sandstones and breccias with calcareous cements in places

IGNEOUS ROCKS

Dykes,sills and small masses

TERTIARY

- D^A_T — Olivine-dolerite, and analcite-olivine-dolerite
- D^T_T — Tholeiitic dolerite

TERTIARY OR PERMO-CARBONIFEROUS

- A — Andesitic intrusion, unclassed

LATE CARBONIFEROUS

- qD — Quartz dolerite

METAMORPHIC ROCKS

METASEDIMENTARY ROCKS

PRECAMBRIAN — **DALRADIAN**

SOUTHERN HIGHLAND GROUP

- Z_{BB}, Q^G_{BB}, V_{BB} — **Beinn Bheula Schist:** quartz-mica chlorite schists, often gritty, with phyllites, albite schists and chlorite-epidote schists. Prominent grit beds (Z_{BB}) and probable metavolcanic rocks (V_{BB}) occur in places
- QV_{GB} — **Green Beds:** quartz-mica schists and quartz schists with abundant beds of chlorite-epidote schist, probably of volcanic origin. The lighter tone indicates areas where the occurrence of Green Beds is conjectural but considered likely (McCallien, 1927b, 1929a). The darker tone indicates areas where Green Beds were mapped during the original survey
- QS_{GS} — **Glen Sluan Schist:** mica schists, often gritty, with conglomerates in places. Chlorite-epidote schists occur locally

ARGYLL GROUP

- **Tayvallich Subgroup**
  - L_T — **Loch Tay Limestone:** Black to grey limestone with calc-silicate-bearing mica-schists and psammitic rocks occurring locally
- **Crinan Subgroup**
  - L_C, PS_C — **Stonefield Schist:** garnet-mica schist with subordinate quartz schist and quartzite; numerous thin limestones
  - V_C, S_C, Q_C — **Erins Quartzite:** quartzites, psammites and quartz-mica schists with subordinate mica schists and phyllites; rare calcareous and gritty beds. Mica schists (S_C) may be extensive in places and chlorite-epidote schists (V_C) of possible volcanic origin occur locally on Gigha Island

METAIGNEOUS ROCKS

- D — Amphibolite: probably originally pre-metamorphic sills

- Glacial striae, bar shows orientation
- Glacial striae, showing inferred direction of ice flow
- Horizontal strata
- 5 — Inclined strata, dip in degrees
- 32 — Inclined dominant foliation, dip in degrees
- Vertical dominant foliation
- Fossil locality, marine shells in clay, possibly overlain by till
- Geological boundary, Drift
- Geological boundary, Solid
- Fault
- Trace of Cowal Antiform, location approximate; southern limit conjectural
- Lineament: linear topographic feature interpreted from topographic maps, probably with a geological origin

Client: RWE	Title: FIGURE 11.3.3b GEOLOGY KEY	AECOM	Drawn: LC / Checked: AC
Project: CLACHAIG GLEN WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT		One Trinity Gardens, Quayside, Newcastle, NE1 2HF — Tel +44 (0) 191 224 6500, Fax +44 (0) 191 224 6599, www.aecom.com	Verified: DL / Approved: SW
			Date: JANUARY 2022
			Drawing Number: CG_220106_EIA_A11.3.3b_v2 — A3

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Clachaig Glen Wind Farm

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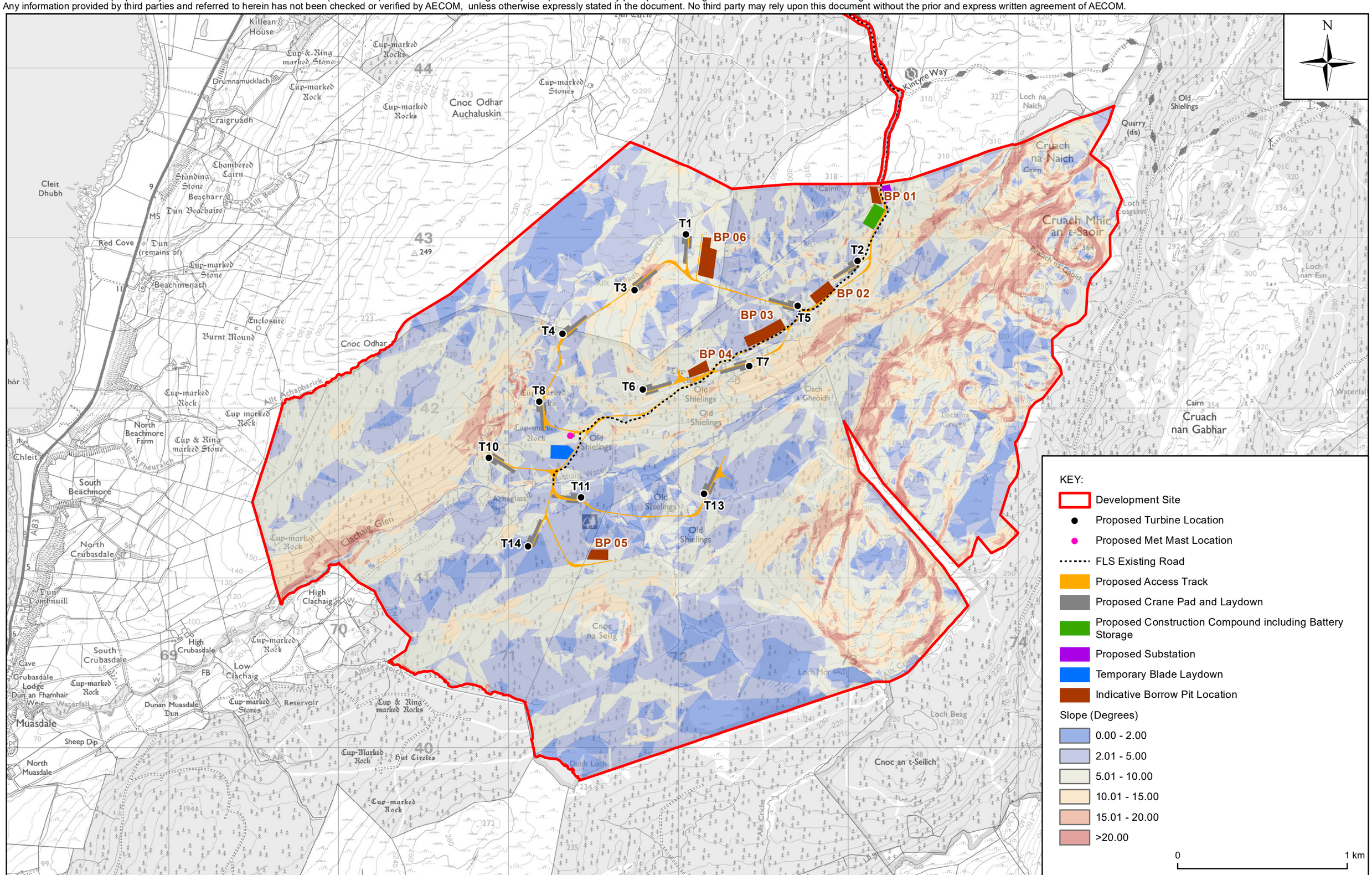
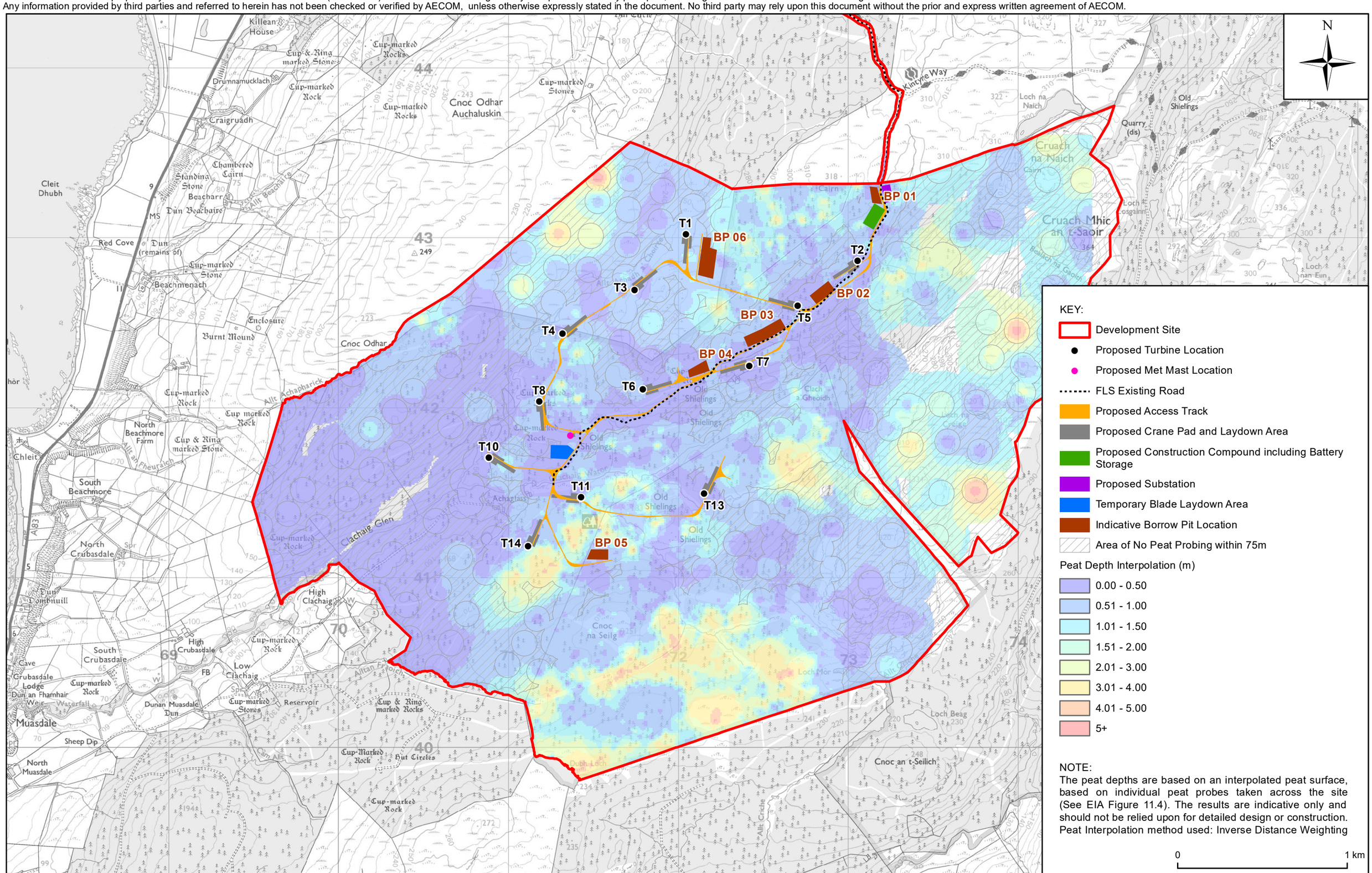
EIAR Technical Appendices

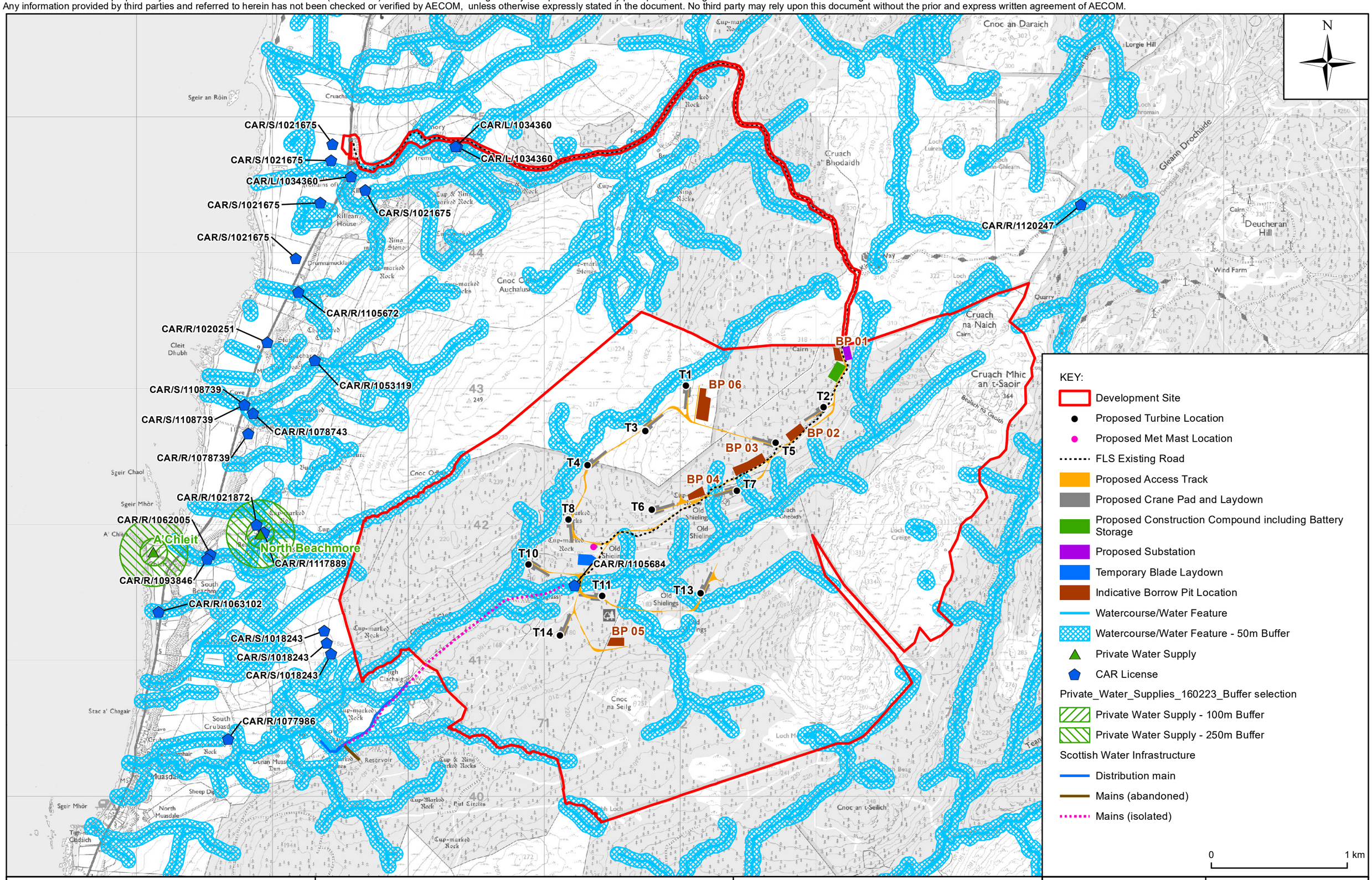
Figures: 11.3.4; 11.3.5; 11.3.6; 11.3.7



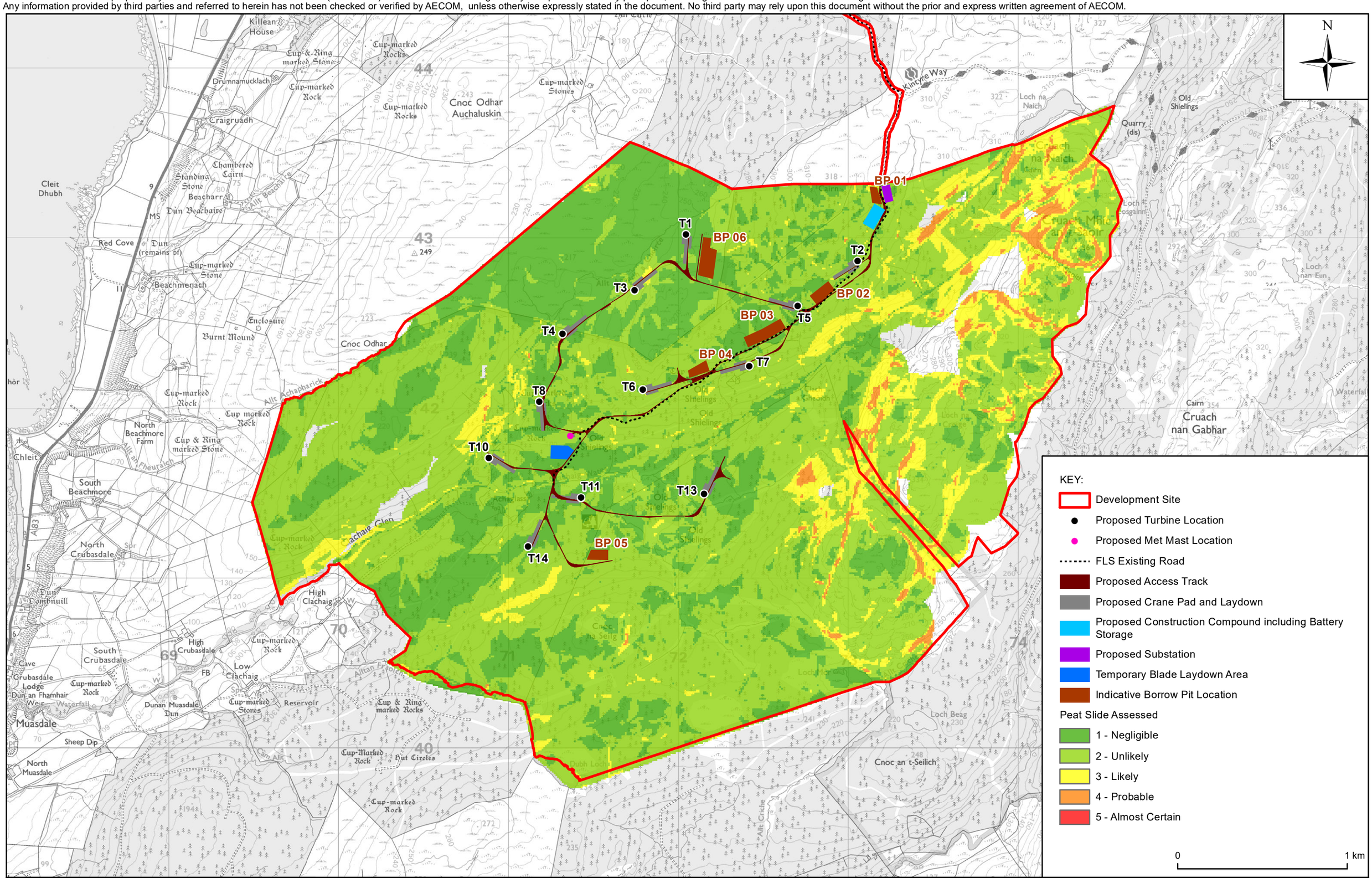
Client: RWE	Title: FIGURE 11.3.4 TOPOGRAPHY	AECOM One Trinity Gardens Quayside Newcastle, NE1 2HF Tel +44 (0) 191 224 6500 Fax +44 (0) 191 224 6599 www.aecom.com	Drawn: LC / Checked: AC
Project: CLACHAIG GLEN WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT			Verified: DL / Approved: SW
			Date: JANUARY 2022 / Scale at A3: 1:20,000
			Drawing Number: CG_220106_EIA_A11.3.4_v2 / A3



Client: RWE	Title: FIGURE 11.3.5 PEAT DEPTH INTERPOLATION	AECOM One Trinity Gardens Quayside Newcastle, NE1 2HF Tel +44 (0) 191 224 6500 Fax +44 (0) 191 224 6599 www.aecom.com	Drawn: LC · Checked: AC
Project: CLACHAIG GLEN WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT			Verified: DL · Approved: SW
			Date: JANUARY 2022 · Scale at A3: 1:20,000
			Drawing Number: CG_220106_EIA_A11.3.5_v2 · A3



Client: RWE	Title: FIGURE 11.3.6 HYDROLOGY	AECOM One Trinity Gardens Quayside Newcastle, NE1 2HF Tel +44 (0) 191 224 6500 Fax +44 (0) 191 224 6599 www.aecom.com	Drawn: LC · Checked: AC Verified: DL · Approved: SW Date: JANUARY 2022 · Scale at A3: 1:25,000 Drawing Number: CG_220106_EIA_A11.3.6_v1 · A3
Project: CLACHAIG GLEN WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT			



Client: RWE	Title: FIGURE 11.3.7 PEAT SLIDE ASSESSED HAZARD	AECOM One Trinity Gardens Quayside Newcastle, NE1 2HF Tel +44 (0) 191 224 6500 Fax +44 (0) 191 224 6599 www.aecom.com	Drawn: LC / Checked: AC
Project: CLACHAIG GLEN WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT			Verified: DL / Approved: SW
			Date: FEBRUARY 2022 / Scale at A3: 1:20,000
			Drawing Number: CG_220221_EIA_A11.3.7_v3 / A3

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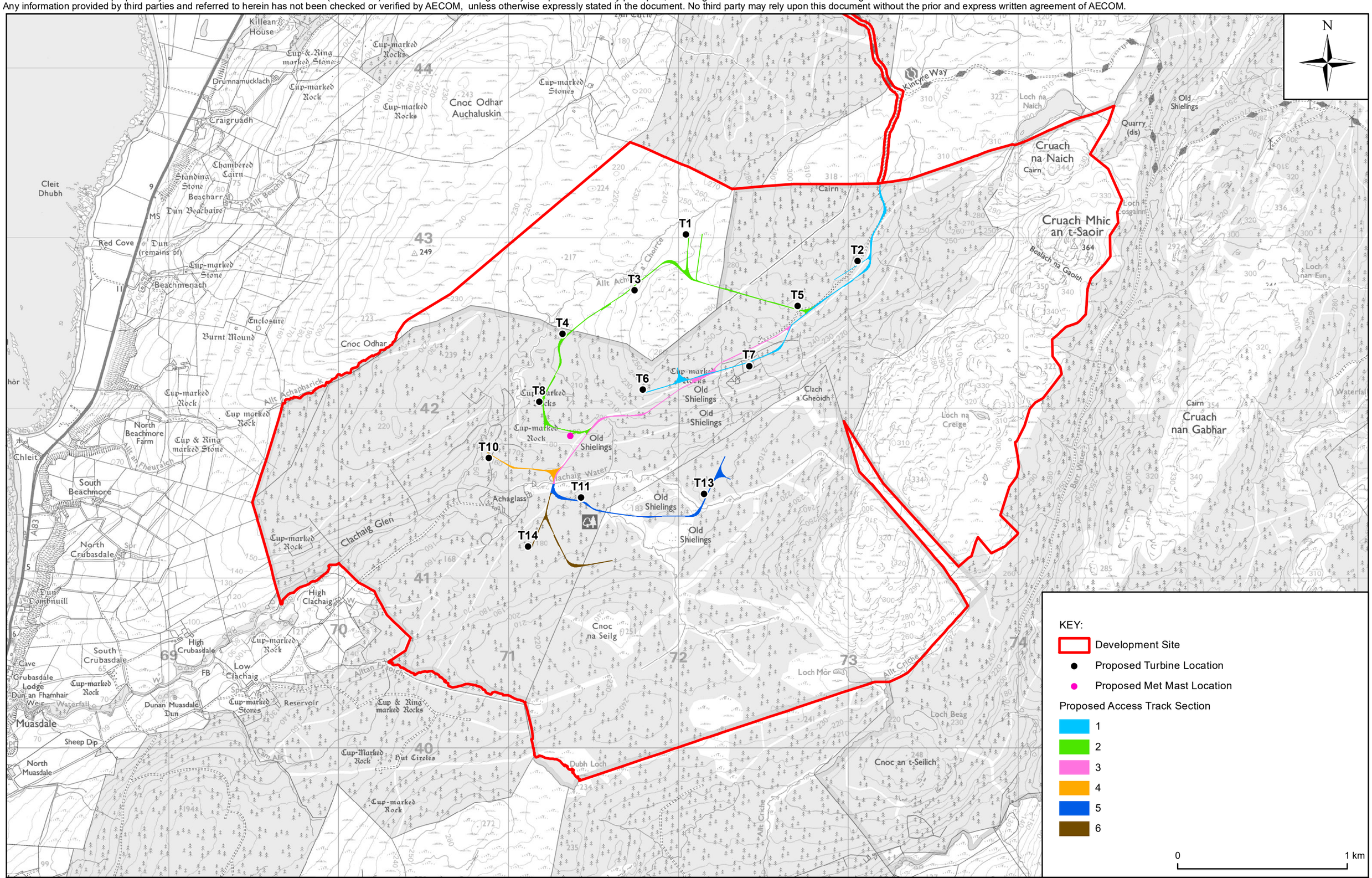
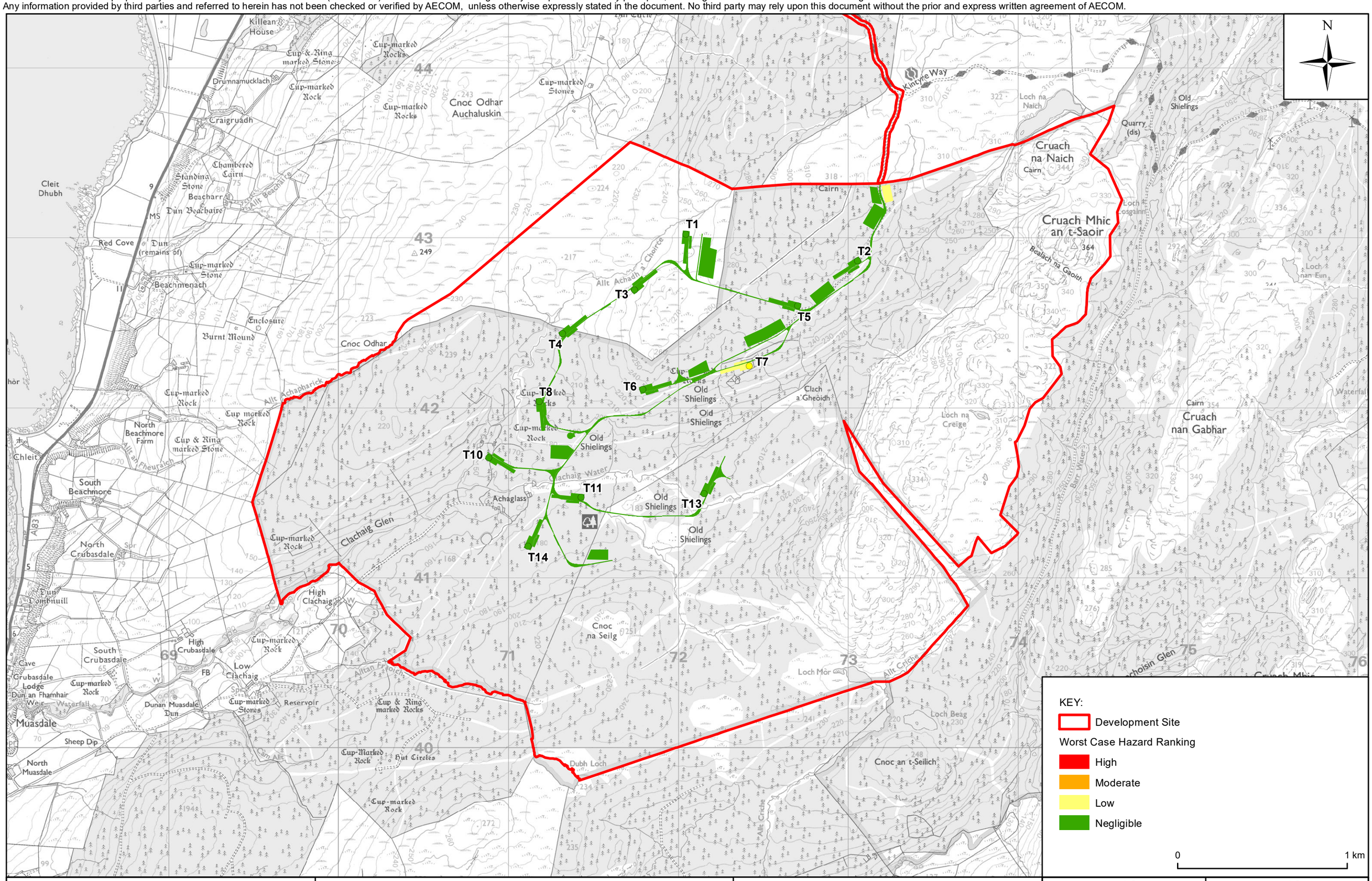
EIAR Technical Assessment Figures

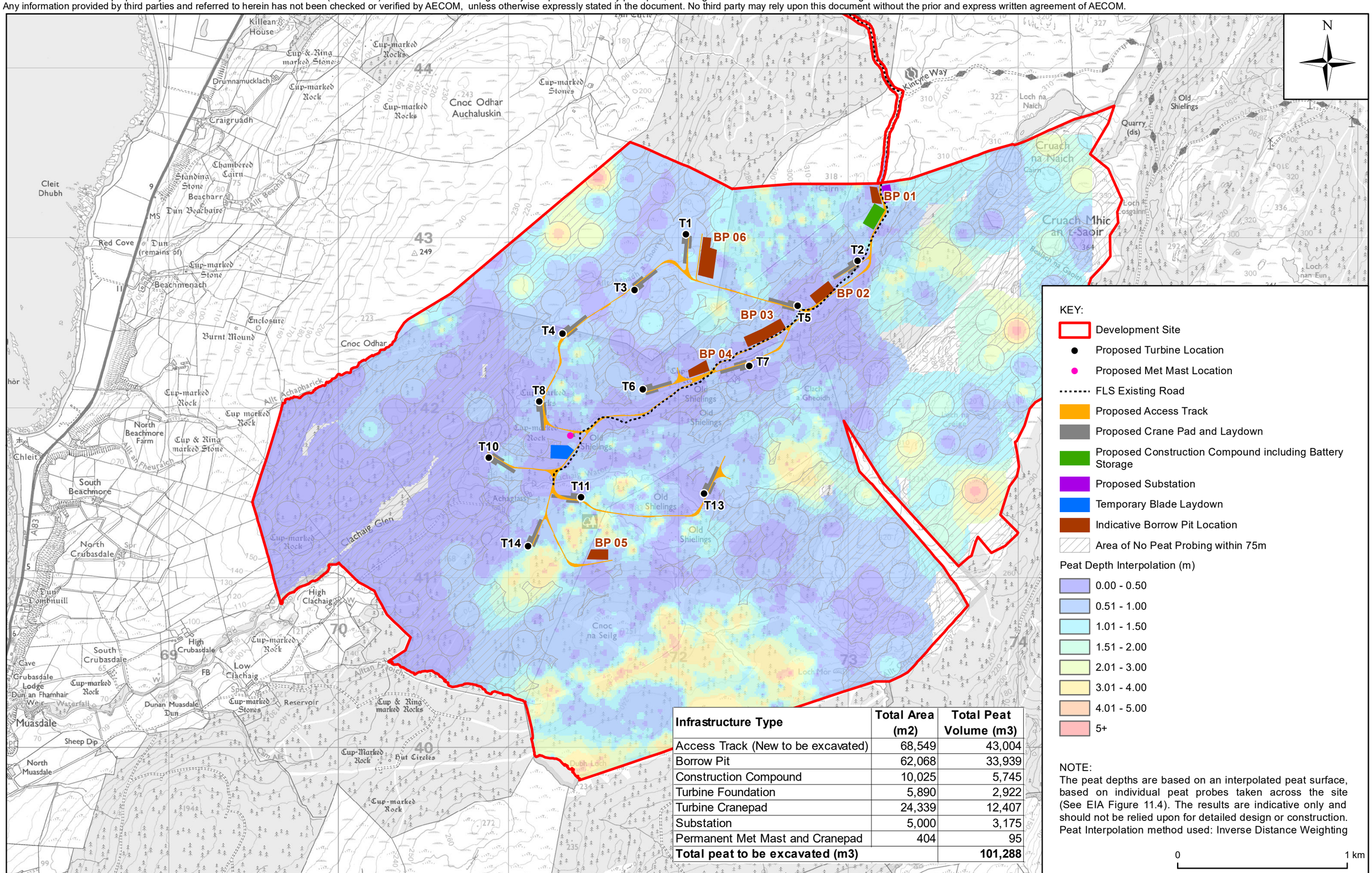
Figures: 11.3.8; 11.3.9; 11.4.1



Client: RWE	Title: FIGURE 11.3.8 ACCESS ROAD SECTIONS	AECOM One Trinity Gardens Quayside Newcastle, NE1 2HF Tel +44 (0) 191 224 6500 Fax +44 (0) 191 224 6599 www.aecom.com	Drawn: LC · Checked: AC Verified: DL · Approved: SW Date: JANUARY 2022 · Scale at A3: 1:20,000 Drawing Number: CG_220106_EIA_A11.3.8_v2 · A3
Project: CLACHAIG GLEN WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT			



Client: RWE	Title: FIGURE 11.3.9 WORST CASE HAZARD RANKING	AECOM One Trinity Gardens Quayside Newcastle, NE1 2HF Tel +44 (0) 191 224 6500 Fax +44 (0) 191 224 6599 www.aecom.com	Drawn: LC · Checked: AC Verified: DL · Approved: SW Date: JANUARY 2022 · Scale at A3: 1:20,000 Drawing Number: CG_220106_EIA_A11.3.9_v1 · A3
Project: CLACHAIG GLEN WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT			



Infrastructure Type	Total Area (m2)	Total Peat Volume (m3)
Access Track (New to be excavated)	68,549	43,004
Borrow Pit	62,068	33,939
Construction Compound	10,025	5,745
Turbine Foundation	5,890	2,922
Turbine Cranepad	24,339	12,407
Substation	5,000	3,175
Permanent Met Mast and Cranepad	404	95
Total peat to be excavated (m3)		**101,288**

NOTE:
The peat depths are based on an interpolated peat surface, based on individual peat probes taken across the site (See EIA Figure 11.4). The results are indicative only and should not be relied upon for detailed design or construction. Peat Interpolation method used: Inverse Distance Weighting

Client: RWE

Project: CLACHAIG GLEN WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT

Title: FIGURE 11.4.1 PEAT EXCAVATION

AECOM
One Trinity Gardens
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Newcastle, NE1 2HF
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www.aecom.com

Drawn:	LC	Checked:	AC
Verified:	DL	Approved:	SW
Date:	JANUARY 2022	Scale at A3:	1:20,000
Drawing Number:	CG_220106_EIA_A11.4.1_v5		A3

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Clachaig Glen Wind Farm

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Technical Appendices

Appendices

12.1, 12.2, and 12.3

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Appendix 12.1: Known Heritage Assets

Appendix 12.1 Known Heritage Assets

Table 1 Assets within the Inner Study Area

Reference	Grid Reference	Period	Description	No. on Fig 12.1
NR74SW3 WoSASPIN 3510, 4352	NR 7043 4031	Prehistoric	Low Clachaig, cup marked boulders. **Scheduled Monument**.	1
3223, WoSASPIN 3167	NR 6903 4029	Prehistoric	Dunan Muasdale, dun. **Scheduled Monument**.	2
3659, NR64SE10, WoSASPIN 3148	NR 6952 4246	Prehistoric	Beachmeanach enclosure. **Scheduled Monument.** An area of peat growth is also recorded here.	3
NR64SE.24.-, 3163	NR 6988 4120	Prehistoric	Location of a cup marked stone.	4
58775	NR 69800 41200	Prehistoric	Site of cup and ring markings.	5
NR74SW.23.-, 3505	NR 7100 4187	Prehistoric	Location of a cup marked rock.	6
NR74SW.25.-, WoSASPIN 3507, 59091	NR 71100 41900	Bronze Age	Find spot of a barbed and tanged flint arrowhead.	7
NR74SW.4.-, 3511	NR 7096 4201	Prehistoric	Location of a cup marked stone.	8
NR74SW.5.-, WoSASPIN 3512	NR 7109 4212	Prehistoric	Location of a cup marked stone.	9
NR74SW.32.-45056	NR 7091 4188	Post-Medieval?	Achahoirk Farmstead, Head Dyke.	10
59089	NR 70885 41785	Post-Medieval?	Site of a croft.	11
58770	NR 70800 42000	Prehistoric	Site of cup and ring markings.	12
58772	NR 71200 42200	Prehistoric	Site of cup and ring markings.	13

Reference	Grid Reference	Period	Description	No. on Fig 12.1
58771	NR 71000 41800	Prehistoric	Site of cup and ring markings.	14
59090	NR 70944 41416	Post-Medieval?	Site of a croft.	15
59093	NR 71098 40798	Prehistoric	Lithic find spot.	16
59092	NR 71122 41487	Post-Medieval?	Location of a sheepfold.	17
59503	NR 71135 41528	Post-Medieval?	Location of a corn drying kiln.	18
NR74SW.16.-, WoSASPIN 3497, 59088	NR 7127 4167	Medieval?	Site of an enclosure.	19
NR74SW.21.-, WoSASPIN 3503, 59087	NR 7162 4167	Bronze or Iron Age& Post-Medieval	Location of a possible hut circle. A shieling is also recorded in this location.	20
NR74SW.20.-, WoSASPIN 58769	NR 715 418	Post-Medieval	Location of shieling huts.	21
3502	NR 71602 41846	Post-Medieval	Location of a shieling hut.	22
3502	NR 71624 41807	Post-Medieval	Location of a shieling hut.	23
3502	NR 71630 41810	Post-Medieval	Location of a shieling hut.	24
3502	NR 71639 41806	Post-Medieval	Location of a shieling hut.	25
3502	NR 71592 41834	Post-Medieval	Location of a shieling hut.	26
3502	NR 71569, 41853	Post-Medieval	Location of a shieling hut.	27
3502	NR 71522 41864	Post-Medieval	Location of a shieling hut.	28
3499	NR 71724 41428	Post-Medieval	Location of a shieling hut.	29
3499	NR 71752 41458	Post-Medieval	Location of a shieling hut.	30
3499	NR 71764 41482	Post-Medieval	Location of a shieling hut.	31
3499	NR 71776 41471	Post-Medieval	Location of a shieling hut.	32
3499	NR 71788 41467	Post-Medieval	Location of a shieling hut.	33
58773	NR 71700 41400	Post-Medieval	Location of a shieling hut.	34
3500	NR 71950 41221	Post-Medieval	Location of a shieling hut.	35
3500	NR 71967 41219	Post-Medieval	Location of a shieling hut.	36
3500	NR 71984 41220	Post-Medieval	Location of a shieling hut.	37
3500	NR 71985 41240	Post-Medieval	Location of a shieling hut.	38

Reference	Grid Reference	Period	Description	No. on Fig 12.1
3500	NR 71962 41263	Post-Medieval	Location of a shieling hut.	39
3500	NR 71950 41250	Post-Medieval	Location of a shieling hut.	40
38908 WoSASPIN 58774	NR 71900 41200	Post-Medieval	Location of a shieling hut.	41
NR74SW.28.-, WoSASPIN 12927	NR 721 408	Prehistoric?	Find spot of possible ard.	42
58776	NR 72100 41900	Post-Medieval	Site of a shieling.	43
3504	NR 72236 42120	Post-Medieval	Location of a shieling hut.	44
3504	NR 72223 42116	Post-Medieval	Location of a shieling hut.	45
3504	NR 72256 42062	Post-Medieval	Location of a shieling hut.	46
3504	NR 72261 42052	Post-Medieval	Location of a shieling hut.	47
3504	NR 72252 42039	Post-Medieval	Location of a shieling hut.	48
3504	NR 72248 42023	Post-Medieval	Location of a shieling hut.	49
3504	NR 72264 42029	Post-Medieval	Location of a shieling hut.	50
3504	NR 72282 42026	Post-Medieval	Location of a shieling hut.	51
3504	NR 72261 41977	Post-Medieval	Location of a shieling hut.	52
3504	NR 72274 41970	Post-Medieval	Location of a shieling hut.	53
3504	NR 72291 41979	Post-Medieval	Location of a shieling hut.	54
3504	NR 72305 41964	Post-Medieval	Location of a shieling hut.	55
3504	NR 72255 41859	Post-Medieval	Location of a shieling hut.	56
3504	NR 72276 41877	Post-Medieval	Location of a shieling hut.	57
3504	NR 72291 41899	Post-Medieval	Location of a shieling hut.	58
3504	NR 72308 41896	Post-Medieval	Location of a shieling hut.	59
3504	NR 72309 41906	Post-Medieval	Location of a shieling hut.	60
3504	NR 72378 41942	Post-Medieval	Location of a shieling hut.	61
3504	NR 72393 41950	Post-Medieval	Location of a shieling hut.	62
58777	NR 72200 42000	Post-Medieval	Location of a shieling hut.	63
58778	NR 72200 42100	Prehistoric	Site of cup and ring marks.	64
NR74SW.6.-	NR 7224 4216	Prehistoric	Location of a cup marked stone.	65

Reference	Grid Reference	Period	Description	No. on Fig 12.1
3513	NR 72244 42173	Prehistoric	Site of cup markings.	66
3513	NR 72254 42160	Prehistoric	Site of cup markings.	67
59086	NR 72354 42150	Post-Medieval?	Location of a sheepfold.	68
58935	NR 72300 42500	Modern	Location of an aircraft wreck.	69
58779	NR 72900 43200	Unknown	Site of a cairn, possibly a marker cairn.	70
59246	NR 73488 42945	Post-Medieval	Site of a shieling.	71
14206	NR 73437 42687	Post-Medieval	Location of a shieling hut.	72
58780	NR 73400 42700	Post-Medieval	Site of a shieling.	73
59245	NR 73406 42625	Post-Medieval	Site of a shieling.	74
NR74SW.29.-	NR 734 426	Post-Medieval	Site of shieling huts.	75
58939	NR 74198 43418	Unknown	Location of a cairn, located at a summit.	76
43248	NR 74760 43650	Post-Medieval?	Location of a quarry.	77
3498	NR 74988 43735	Post-Medieval	Location of a shieling hut.	78
3498	NR 74970 43707	Post-Medieval	Location of a shieling hut.	79
58356	NR 74977 43724	Post-Medieval	Site of a shieling.	80
3489	NR 75058 43791	Post-Medieval	Site of shieling huts.	81
3489	NR 75074 43807	Post-Medieval	Site of shieling huts.	82
3489	NR 75082 43815	Post-Medieval	Site of shieling huts.	83
58357	NR 75073 43794	Post-Medieval	Site of a shieling.	84
3488	NR 75427 44311	Post-Medieval	Location of a shieling hut.	85
3488	175417, 644296	Post-Medieval	Location of a shieling hut.	86
3488	175383, 644207	Post-Medieval	Location of a shieling hut.	87
NR74SE.3-58365	NR 75400 44283	Post-Medieval	Location of a shieling hut.	88
NR74SW.39.-, 43249	NR 7463 4410	Post-Medieval?	Location of a quarry.	89
NR74SW.38.-, 43250	NR 7450 4400	Post-Medieval?	Location of a quarry.	90
51638, 58349	NR 75100 42000	Unknown	Location cairns, located at a summit.	91
51629, 58345	NR 74400 41750	Post-Medieval	Site of a shieling.	92
51623	NR 74230 41090	Post-Medieval	Site of a shieling.	93
58344	NR 74237 41153	Post-Medieval	Site of a shieling.	94

Reference	Grid Reference	Period	Description	No. on Fig 12.1
51625	NR 74230 40660	Post-Medieval	Site of a shieling.	95
51624	NR 74230 40520	Post-Medieval	Site of a shieling.	96
58377	NR 74500 40600	Post-Medieval	Site of a shieling.	97
51627, 58375	NR 74460 40440	Post-Medieval	Site of a shieling.	98
15558	NR 71650 44750	Prehistoric	Cup Markings. Eight solo cups on southern face and seven solo cups on eastern and top face of a boulder.	99
59469	NR 73974 40306	Post-Medieval	Site of a shieling.	100
51642, 58224	NR 73800 39920	Unknown	Location of a large circular enclosure, surviving as an earthwork.	101
51597	NR 73700 39650	Unknown	Location of a field enclosure.	102
51626	NR 73980 39720	Post-Medieval	Site of a shieling.	103
51635, 58373	NR 73970 39710	Post-Medieval?	Location of a sheepfold.	104
51633, 58348	NR 73420 39530	Unknown	Location of a field enclosure.	105
51632, 58341	NR 73250 39380	Post-Medieval	Location of a field enclosure.	106
NR73NW.30.-	NR 7313 3936	Post-Medieval	Bar Glenn farmstead.	107
NR73NW.13.-, WoSASPIN 3441	NR 7255 3914	Bronze or Iron Age?	Location of a cairnfield and/or hut circle.	108
NR73NW.27.-, WoSASPIN 14531	NR 725 391	Perhaps Bronze/ Iron Age?	Site of a clearance cairn.	109
3483	NR 71989 45054	Prehistoric	Loch Dirigadale cup-marked bolder. This cup-marked boulder measures 0.8m by 0.7m. On its upper face, which is inclined to the north west, there are at least nine cup marks.	110
NR73NW.33.-, 20075	NR 720 394	Post-Medieval	Site of shieling huts.	111
14528 NR73NW.25.-	NR 71968 38993	Post-Medieval?	Location of a farmstead and corn-drying kiln.	112
3490	NR 71880 44710	Bronze Age	A gold bracelet was found in a rabbit hole close to Killean House.	113
NR73NW.3.-, WoSASPIN 3451	NR 7018 3965	Prehistoric	Location of a cup marked stone.	114
NR73NW.19.-	NR 7023 3992	Prehistoric	Location of a cup marked stone.	115
NR73NW.20.-,	NR 7024 3990	Bronze or Iron Age	Site of hut circles.	116

Reference	Grid Reference	Period	Description	No. on Fig 12.1
3449				
NR74SW.27.-, WoSASPIN 3509	NR 7003 4065	Post-Medieval	Site of High Clachaig House dating to the 18th or 19th century.	117
NR64SE.42.-, WoSASPIN 43180	NR 6999 4085	Post-Medieval	Location of High Clachaig Farmstead.	118
NR64SE.8.-, WoSASPIN 3182	NR 6976 4059	Prehistoric	Location of a cup marked stone.	119
NR64SE.17.-, WoSASPIN 3155	NR 6960 4028	Prehistoric	Location of a cup marked stone.	120
NR64SE.16.-, WoSASPIN 3154	NR 6948 4034	Prehistoric	Location of a cup marked stone.	121
NR64SE.18.-, WOSASPIN 3156	NR 6938 4032	Prehistoric	Location of a cup marked stone.	122
NR64SE.37.-, WoSASPIN 3177	NR 6913 4005	Late Prehistoric?	Site of an enclosure, which are possible traces of an outer wall.	123
NR64SE.43.-, WoSASPIN 43181	NR 6929 4056	Post-Medieval	Location of Low Clachaig Farmstead.	124
3495	NR 70050 44950	Unknown	There may have once been a church or chapel at Kilmory. No further evidence to support this.	125
NR64SE.29.-, WoSASPIN 3168	NR 687 411	Prehistoric	Find spot of a stone mace head.	126
NR64SE.6.-, WoSASPIN 3180	NR 6929 4193	Prehistoric	Location of a cup marked stone.	127
NR64SE.44.-, WoSASPIN 43179	NR 6906 4224	Post-Medieval?	Location of Beachmeanach Farmstead.	128
NR64SE.11.-, WoSASPIN 3149	NR 6963 4218	Unknown	Site of a possible standing stone which is not likely to be of antiquity .	129
NR64SE.12.-, WoSASPIN 3150	NR 6947 4228	Medieval?	Possible kerb cairn/lazy beds.	130

Reference	Grid Reference	Period	Description	No. on Fig 12.1
21847	NR 69550 42350	Prehistoric	Site of a kerb cairn.	131
NR64SE.32.-, WOSASPIN 3172	NR 6939 4246	Unknown	Location of a burnt mound.	132
21848, NR64SE41	NR 69250 42550	Prehistoric	Site of cup marks.	133
15562, NR64NE41	NR 69200 425500	Prehistoric	Site of cup markings.	134
NR64SE.26.-, WoSASPIN 3165	NR 6934 4272	Unknown	Find spot of human remains and a mound which is possibly a natural feature.	135
NR64SE.5.-, WoSASPIN 3179	NR 6910 4280	Prehistoric	Location of a cup marked stone.	136
NR64SE.9.-, WoSASPIN 3183	NR 6952 4295	Unknown Early Medieval/ Medieval?	Stone remnant of destroyed wall.	137
NR74SW.34.-, WoSASPIN 45052	NR 7138 4374	Post-Medieval?	Site of Killean Burn Farmstead.	138
NR74SW.35.-, WoSASPIN 43253	NR 7315 4411	Post-Medieval?	Location of a quarry.	139
NR74SW.36.-, WoSASPIN 43252	NR 7330 4383	Post-Medieval?	Location of a quarry.	140
NR74SW.37.- WoSASPIN 43251	NR 7350 4392	Post-Medieval?	Location of a quarry.	141
3508	NR 71800 44600	Prehistoric	A stone, bearing over 20 cups, was uncovered by ditching in a field south of Braids farm.	142
3514	NR 70661 44492	Prehistoric	A cup and ring marked stone lies 90m south of the gorge of the Killean Burn. Scattered over its level upper surface there are forty-two well-marked cups ranging from 0.025m to 0.076m in diameter and up to 0.013 m in depth.	143
3447	NR 7023 3992	Prehistoric	Site of cup markings.	144
43247	NR 71950 44950	Post-medieval	Industrial; Limekiln	145

Reference	Grid Reference	Period	Description	No. on Fig 12.1
14533	173096, 639342	Post-Medieval	Location of a ruinous farmstead.	146
14533	173166, 639355	Post-Medieval	Location of a ruinous farmstead.	147
14533	173154, 639376	Post-Medieval	Location of a ruinous farmstead.	148
3449	NR 7024 3990	Bronze or Iron Age	Location of hut circles.	149
3491	NR 70410 43730	Prehistoric	Site of possible cup marks.	150
3492	NR 71742 44356	Bronze or Iron Age	Location of a hut circle.	151
3493	NR 7172 4435	Prehistoric	Possible cup markings.	152
3494	NR 171465 643898	Prehistoric	Site of cup markings.	153
3501	NR 71768 44420	Prehistoric	Site of cup markings	154
3501	NR 71767 44397	Prehistoric	Site of cup markings	155
3506	NR 71681 44469	Prehistoric	Site of cup markings	156
45053	NR 7155 4417	Post-Medieval	Location of a farmstead and lime kiln.	157
53240	NR 71787 44419	Prehistoric	Site of a cup and ring marked rock.	158
58372	NR 73976 39672	Post-Medieval?	Location of a bloomery.	159
58374	NR 73958 39684	Post-Medieval?	Site of a sheepfold.	160
62886	NR 71491 43899	Post-Medieval	Location of farmstead.	161
62891	NR 71545 43973	Post-Medieval?	Site of a lime kiln.	162
13295, 38579	NR 6928 4184	Prehistoric	North Beachmore, rock art panels on a monolith and two rock outcrops. The monolith is 1.5m high and the decorated surface faces south west. There are over 50 cup marks upon the monolith. The rock outcrops small areas of exposed rock within the surrounding pasture land. The eastern rock is decorated with a least 12 cup marks and the western has at least eight. **Scheduled Monument**	163
13295, 38579	NR 69200 41980	Prehistoric	North Beachmore, rock art panels on a monolith and two rock outcrops. The monolith is 1.5m high and the decorated surface faces south west. There are over 50 cup marks upon the monolith. The rock outcrops small areas of exposed rock within the surrounding pasture land. The eastern rock is decorated with a least 12 cup marks and the western has at least eight. **Scheduled Monument**	163
13295, 38579	NR 69110 41980	Prehistoric	North Beachmore, rock art panels on a monolith and two rock outcrops. The monolith is 1.5m high and the decorated surface faces south west. There are over 50 cup marks upon the monolith. The rock outcrops small areas of exposed rock within the surrounding pasture land. The eastern rock is decorated with a	163

Reference	Grid Reference	Period	Description	No. on Fig 12.1
			least 12 cup marks and the western has at least eight. **Scheduled Monument**	
SM3179	NR 70201 44780	Prehistoric	Fort NE of Killean. **Scheduled Monument.**	164
SM3030	NR 69507 44572	Medieval	St John's Church, church, burial ground and carved stones, Killean. **Scheduled Monument.**	165
62882	NR 69840 44370	Post-Medieval	Country house. Killean Ho.	166
62884	NR 71855 45022	Post-Medieval	Limekiln	167
WOSASPIN 57264	NR 7194 4424	Post-Medieval	Bracken-covered dyke runs out of survey area into adjacent woodland and measures 1.8m wide (spread) and up to 0.3m high. Recorded as part of the 'Braids Woodland Creation Scheme assessment'.	168
WOSASPIN 57265	NR 7173 4372	Post-Medieval	A rectangular shaped structure built using turf and some stone, measuring 6.5m SE-NW by 8.0m SW-NE internally with banks spread to 0.8m wide and standing up to 0.3m high. No visible entrance. Recorded as part of the 'Braids Woodland Creation Scheme assessment'.	169
WOSASPIN 57266	NR 7161 4356	Post-Medieval	Located just outside the boundary fence at the SSW end of Survey Area 2 is a double cell shieling located on a rocky/grassy knoll. The S cell measures 5.0m N-S by 2.0m E-W internally with walls 0.6m wide and 0.4m high; the N cell is 2.0m N-S by 2.2m E-W with walls with same dimensions. Entrances to both cells facing N and NE respectively. Recorded as part of the 'Braids Woodland Creation Scheme assessment'.	170
WOSASPIN 57267	NR 7159 4377	Post-Medieval	Fragments of turf and stone-built dyke form relict field system and measures up to 1.5m wide (spread) and up to 0.6m high. Dyke covered in rushes, long grasses and some heather. Recorded as part of the 'Braids Woodland Creation Scheme assessment'.	171
WOSASPIN 57268	NR 7173 4409	Post-Medieval	Fragment of turf and stone dyke runs in valley bottom between two stream courses. Measures 1.4m wide and up to 0.6m high. Grass, rushes and bracken-covered. Recorded as part of the 'Braids Woodland Creation Scheme assessment'.	172
WOSASPIN 57269	NR 7181 4427	Post-Medieval	Fragments of turf and stone dyke measure up 1.8m spread and between 0.4-1.0m high. Recorded as part of the 'Braids Woodland Creation Scheme assessment'.	173
WOSASPIN 57270	NR 7180 4444	Post-Medieval	A short fragment of boulder and turf dyke hidden by dense bracken measures 1.2m wide at base and stands up to 0.6m high. Runs around face of prominent	174

Reference	Grid Reference	Period	Description	No. on Fig 12.1
			knoll. Recorded as part of the 'Braids Woodland Creation Scheme assessment'.	
WOSASPIN 57271	NR 7174 4436	Post-Medieval	Fragments of turf and stone dyke follow stream course with banks spread up to 1.5m and standing up to 0.6m high. Recorded as part of the 'Braids Woodland Creation Scheme assessment'.	175
WOSASPIN 57272	NR 7156 4402	Post-Medieval	Covered in bracken is a dyke which uses some large boulders in its construction and which may be an earlier feature used in the post-medieval period. The bank is 1.5-2.0m spread and stands up to 0.3-0.6m high. Recorded as part of the 'Braids Woodland Creation Scheme assessment'.	176
Walkover Survey	NR 71969 42745	Prehistoric	Rock outcrops with a number of cup marks carved on the south facing side of the outcrop.	177
LB13074	NR 69511 44422	Post-Medieval	Killean House. **Category B Listed Building.**	178
LB43250	NR 69578 44620	Post-Medieval	Killean Hall, a former school. **Category B Listed Building**	179
LB12006	NR 69575 44538	Post-Medieval	Killean Home Farm (northern Range). **Category B Listed Building**	180
LB43266	NR 69580 44677	Post-Medieval	The Doll's House, Killean (north range, south wing). **Category A Listed Building**	181
LB43266	NR 69581 44665	Post-Medieval	The Doll's House (south range, north wing). **Category A Listed Building**	182
LB43266	NR 69581 44687	Post-Medieval	The Doll's House (north range, north wing). **Category A Listed Building**	183
LB13073	NR 69550 44452	Post-Medieval	Killean House Farmhouse. **Category B Listed Building**	184
LB12006	NR 69555 44504	Post-Medieval	Killean Home Farm (southern Range). **Category B Listed Building**	185
LB43266	NR 69580 44657	Post-Medieval	The Doll's House (south range, south wing). **Category A Listed Building**	186
WOSASPIN 51917	NR 69555 44504	Post-Medieval	Killean Home Farmhouse and Farmstead	187
WOSASPIN 51918	NR 69575 44538	Post-Medieval	Killean Home Farmhouse and Farmstead (Northern Range)	188
WOSASPIN 62882	NR 69840 44370	Post-Medieval	The site of Killean House as mapped on ordnance survey first edition maps. A large building of unknown date that was burnt down and replaced by the extant Killean House.	189
WOSASPIN 62884	NR 71855 45022	Post-Medieval	A limekiln is marked on Ordnance Survey First Edition Maps.	190
69213	NR 71851 44640	Prehistoric	Cup Marked Rock.	191
69214	NR 71924 45055	Post-Medieval	Dyke.	192

Reference	Grid Reference	Period	Description	No. on Fig 12.1
69215	NR 71987 45040	Post-Medieval	Quarry.	193
69216	NR 71990 45009	Post-Medieval	Quarry; Dyke.	194
69217	NR 71980 44939	Post-Medieval	Quarry.	195
69218	NR 71985 44929	Post-Medieval	Quarry.	196
69219	NR 71991 44841	Post-Medieval	Sheep Fold.	197
69220	NR 71897 44923	Post-Medieval	Dyke.	198
69221	NR 71864 44847	Post-Medieval	Track.	199
69222	NR 71825 44832	Post-Medieval	Dyke.	200
69223	NR 71855 44784	Post-Medieval	Building.	201

Table A-12. 2 Assets within the Wider Study Area

Reference	Grid Reference	Period	Description	No. on Fig 12.3
SM4352	NR 704 403	Prehistoric	The boulder, which is now split, bears cup and ring marks on both halves. The larger part measures 2.4m by 2.1m and bears 54 cupmarks up to 0.1m in diameter and 0.38m deep. Three cups have single rings round them and three have double rings. Two pairs of cups are joined by short channels. The smaller half measures 2.4m by 1.5m and bears thirty-nine cupmarks, six of which are surrounded by incomplete rings. The marks are somewhat weathered. Kintyre contains one of the heaviest concentrations of cup and ring markings in Scotland. Most of them are on boulders on the hills overlooking the west coast. Within this spread there are occasional concentrations. In the concentration around Low Clachaig the boulders lie on the sides of small valleys to the north of the split boulder, and to the south they lie on a west-pointing shoulder of ground. In all, eight boulders are known, in an area measuring roughly 4km by 1km and triangular in shape with its point to the south. **Scheduled Monument.**	1
SM3223	NR 690 402	Prehistoric	Prehistoric domestic and defensive: dun. **Scheduled Monument.**	2

Reference	Grid Reference	Period	Description	No. on Fig 12.3
58775	169800, 641200	Prehistoric	Cup marked boulder.	5
3505	171010, 641876	Prehistoric	Cup marked rock which may be weathered examples.	6
3511	170965, 642012	Prehistoric	Cup marked boulder with at least 30 cups.	8
3512	171099, 642125	Prehistoric	Cup marked boulder with at least 17 cups.	9
58770	170800, 642000	Prehistoric	Cup marked boulder.	12
58771	171000, 641800	Prehistoric	Cup marked boulder.	14
58772	171200, 642200	Prehistoric	Cup marked boulder.	13
58778	172200, 642100	Prehistoric	Cup marked boulder.	64
3513	172244, 642173	Prehistoric	Two cup marked boulders with six cups on one and 14 on the other.	66
3513	172254, 642160	Prehistoric	Two cup marked boulders with six cups on one and 14 on the other.	67
15558	171650, 644750	Prehistoric	Cup markings, eight on the southern face and seven on the eastern and top face of a boulder.	99
3451	170182, 639661	Prehistoric	Location of two cup marked boulder.	114
3182	169760, 640590	Prehistoric	Cup marked stone beside a gatepost bearing 12 cups.	119
3155	169600, 640280	Prehistoric	Cup marked stone near a water tank. During the construction of the tank, the stone was overturned so the cups are no longer visible.	120
3154	169480, 640340	Prehistoric	A small stone with four plain cup marks which has been incorporated into the south corner of Low Clachaig barn.	121
3156	169380, 640320	Prehistoric	Cup marked stone, although nothing surviving in the location. A naturally depressed stone may be the one originally recorded.	122
3162	168680, 640400	Prehistoric	A cup marked boulder bearing 15 cups.	125
3180	169290, 641930	Prehistoric	Cup marked boulder with at least 13 cups.	127
3508	171800, 644600	Prehistoric	Cup marked stone with over 20 cups.	142
3454	170108, 639202	Prehistoric	Cup marked boulder with six very shallow cups.	143
3447	170220, 639910	Prehistoric	Location of a cup marked boulder.	144
3494	171458, 643892 171465, 643898	Prehistoric	Cup marked stone with at least 10 cups. The second stone has three cups.	153
3501	171768, 644420	Prehistoric	Cup and ring markings on a large flat boulder with an unusual combination of designs including a horse shoe figure, two rayed circles and a design resembling an asterisk.	155
3501	171767, 644397	Prehistoric	Cup and ring markings on a large flat boulder with an unusual combination of designs including a horse shoe figure, two rayed circles and a design resembling an asterisk.	154

Reference	Grid Reference	Period	Description	No. on Fig 12.3
3506	171681, 644469	Prehistoric	Cup marked rock outcrop with at least 12 cups.	156
53240	171787, 644419	Prehistoric	Cup marked boulder.	158
SM13295, 3181	NR 691 420	Prehistoric	The monument comprises an earthfast monolith and two rock outcrops in close proximity, all decorated with prehistoric rock art motifs. The motifs were carved probably during the early prehistoric period, between about 3500 BC and 2500 BC. The monolith now serves as the N side of a gateway between two pasture fields. It measures roughly 0.9m wide by 0.3m deep at its base, but tapers towards the top. It stands 1.5m high and now leans at an angle of 45 degrees, with the decorated surface facing SW. Over 50 cup-marks and variations of cup-mark designs have been recorded. The two outcrops are visible at ground level as small areas of exposed rock surface within pasture land. The easternmost is 1.5m long by 0.9m wide and is decorated with at least 12 cup-marks. The visible area of the second outcrop, 120m to the W, measures 1.2m by 1.2m and is decorated with at least eight cup-marks. The monolith and rock outcrops are located on the S and N sides respectively of the Allt Achapharick burn at approximately 120m above sea level. The former has a predominantly E-facing outlook to the Kintyre ridge, while the two rock outcrops are on the W-facing shoulder of the ridge, overlooking the Sound of Gigha, Jura and Islay beyond. The scheduled area comprises three separate circles, centred on the monolith and rock outcrops respectively. The first, 5m in diameter, is centred on the monolith; the second, 8m in diameter, is centred on the westernmost rock outcrop; and the third, 6m in diameter, is centred on the easternmost rock outcrop. The area to be scheduled includes the remains described above and an area around them within which evidence relating to the monument's construction, use and abandonment may survive, as shown in red on the accompanying map. Specifically excluded from the scheduling are the above-ground components of a post-and-wire fence adjacent to the monolith. The monolith may not be in its original position, but it retains significant intrinsic value because of the relatively good condition of the carved motifs and the overall design represented. Antiquarian accounts suggest it has not been disturbed since at least the 1930s. The unusual design includes: single cup-marks; kidney-shaped carvings formed from small groups of cup-marks; a single cup-mark with a concentric, crescent-shaped channel or part-ring; small groups of cup-marks joined by carved channels; and twin cup-marked designs joined by a single channel to form 'dumb-bell' shapes. The motifs	163

Reference	Grid Reference	Period	Description	No. on Fig 12.3
			appear to be spatially discrete, with few if any overlapping. The cups are between 35mm and 76mm in diameter and up to 19mm deep. The two ground-level rock outcrops are decorated with single cup-marks of around the same dimensions. Again, the individual cups are spatially discrete and do not overlap with each other. Despite the vulnerable position of the outcrops at ground level and the location of the monolith at the side of a gateway, all of the carvings are in good condition. Excavations at similar outcropping sites in Argyll have uncovered further buried carvings and associated remains beyond the footprint of the visible panel, including further carvings, artefacts and environmental evidence. This may also be the case here. Any surviving remains associated with the carvings could help us understand the circumstances behind their creation and how the carved panels were used, as well as provide evidence for the nature of the local environment and vegetation at the time the carvings were produced. In the case of all three panels, any development sequence or phasing of the carvings is difficult to determine because most of the components respect each other spatially. Collectively, however, they represent a significant undertaking by the person or people who carved these designs. As well as their high intrinsic value as decorated monuments, these carved panels can enhance our understanding of the carving process and techniques, the relationship between individual motifs and the overall designs, and the meaning and symbolism of the various motifs and designs. **Scheduled Monument.**	
Walkover Survey	NR 71969 42745	Prehistoric	Rock outcrops with a number of cup marks carved on the south facing side of the outcrop.	177
SM3228	NR 652 497	Prehistoric	Prehistoric domestic and defensive: dun. **Scheduled Monument.**	S1
SM3280	NR 665 347	Prehistoric	Prehistoric domestic and defensive: dun. **Scheduled Monument.**	S2
SM3226	NR 673 386	Prehistoric	Prehistoric domestic and defensive: dun. **Scheduled Monument.**	S3
SM3397	NR 630 482	Prehistoric	Prehistoric ritual and funerary: cairn (type uncertain). **Scheduled Monument.**	S4
SM259	NR 642 481		Crosses and carved stones: inscribed stone. **Scheduled Monument.**	S5
SM188	NR 678 391	Prehistoric	Prehistoric ritual and funerary: standing stone. **Scheduled Monument.**	S6
SM3307	NR 643 481		Achamore House, old parish church. **Scheduled Monument.**	S7
SM3227	NR 649 506	Prehistoric	Dunan an t-Seasgain, dun 465m WNW of Drumyeonmore Farm, Gigha. The monument comprises a prehistoric dun likely to date to the Iron Age (between 500	S8

Reference	Grid Reference	Period	Description	No. on Fig 12.3
			BC and AD 500). The dun is visible as a sub-oval enclosure sited on the summit of an isolated rocky knoll in the island of Gigha, at a height of 45m above sea level. Overall the dun measures approximately 35m by 24m. The dun is located inland, towards the centre of the island, but has extensive views over the sea channel E of Gigha and beyond, to the Kintyre peninsula. The monument was first scheduled in 1972, but the documentation does not meet modern standards: the present rescheduling rectifies this. The area to be scheduled is an irregular polygon on plan, to include the remains described above and an area around them within which evidence relating to the monument's construction, use and abandonment may survive, and adjoining land essential for the monument's support and preservation, as shown in red on the accompanying map. The scheduling extends up to but does not include the post-and-wire fence to the N of the knoll. **Scheduled Monument.**	
SM3230	NR 645 500	Prehistoric	Dun Chibhich, fort 400m NW of Druimyeonbeg, Gigha. The fort survives in a stable and relatively good condition, in an area of rough grazing. It takes advantage of the natural defence offered by near-vertical rock faces around its northern end and very steep drops to the W and E. The only easy approach is from the SW. This natural defence is enhanced by a sub-oval, outer wall around the fort's southern circuit. The enclosure wall remains an impressive and substantial feature. It stands more than 1m in height and is over 3m wide in places. There is a well-defined entrance, 1.5m wide, in the SE part of the wall circuit, with a step or threshold at the mouth of the entrance passage. Most of the walling is obscured by vegetation, but in places the lower courses are visible. Vegetation also obscures the remains of any buildings and structures surviving in the interior, although a sunken court measuring 13.5m by 7.5m has been recorded previously, immediately inside the entrance. This fort is of particular interest because of its larger than usual size and, consequently, the possible variety of functions it performed for its prehistoric builders and occupants. Elsewhere, similar forts have been shown to have a greater time-depth than is obvious from the above-ground remains, sometimes with the discovery of Bronze Age (earlier) and medieval (later) artefacts and structures, as well as different phases of Iron Age use. Dun Chibhich may also have been in use over an extended period. Given the good state of preservation of the enclosing wall and the relative remoteness of the location, it is likely that substantial buried remains may survive here, including buildings	S9

Reference	Grid Reference	Period	Description	No. on Fig 12.3
			and occupation debris. The site has high potential to enhance our understanding of the origins, date, nature and development sequence of large defensive sites in western Scotland. Buried deposits, features and structures can elucidate the economic and agricultural basis of the settlement, provide insights into the contacts and social status of the people who built and occupied the site, and allow us to determine the duration of occupation of the fort. The word 'dun' is commonly applied to smaller defensive structures than Dun Chibhich, typically those less than 20m in diameter, which are likely to have been the homesteads of single families. The classification of Iron Age strongholds in Scotland is an ongoing topic of debate among researchers, but Dun Chibhich is considered to be a fort because of its size. Forts are much less common than duns in western Scotland, representing around 10% of the total number of defensive enclosures. This fort is one of a cluster of five broadly contemporary, but smaller defensive sites in Gigha, all of which are named as duns, including the coastal dun at Dun an Trinnse 930m to the NNW and another dun in the interior of the island, Dunan an t Seasgain, 745m to the NE. Researchers have suggested that the location of forts and duns is significant and that they were deliberately positioned to be intervisible, and were also intended both to be visible from the sea and to command good views out to sea. Dun Chibhich has a prominent position on the island atop one of the highest knolls, from where there are commanding views not only to Islay, Jura and Kintyre to the E, but also across the western and eastern sea channels which flank Gigha. Further study of Dun Chibhich and its function alongside the cluster of smaller duns in Gigha has high potential to enhance our understanding of the date, settlement pattern and use of defensive sites in the later prehistoric period. Dun Chibhich is traditionally said to be the approximate location of a 'giant's grave', that of a local chieftain Kifi who, according to folklore, is buried in a stone enclosure to the S of the fort. A substantial sub-rectangular structure is visible in aerial photographs to the S of the fort, but no recorded archaeological evidence is available for its date or function. **Scheduled Monument.**	
LB11449	NR 64273 47866	Post-Medieval	ACHAMORE HOUSE Dated 1884. John Honeyman. Scottish style. Long, rambling block. 2 storeys. Harled gabled slate roofs. Ashlar chimneys. Semi-circular towers; conical roofs. Crow-steps. Bow and bay windows. Portico with Ionic columns, pilasters, entablature, scroll pediment; panel	S10

Reference	Grid Reference	Period	Description	No. on Fig 12.3
			above with date "1884". Good interiors; Oak panelling. Moulded plaster ceilings Remodelled 1900. Contains English late Gothic stone chimney pieces and mid-Georgian wooden chimney pieces. Built for William Scarlett, 3rd Lord Abinger (who had bought Gigha from the McNeills). Damaged by fire shortly afterwards and restored. Now sub-divided. **Listed Building Category B.**	
LB11430	NR 64096 44324	Medieval	CARA CHAPEL (ST. FINLA'S) Oblong chamber. Rubble, partly dilapidated; roofless. Pointed door-way and flat-headed window on N. side. Ruin. Adjoining Cara House and converted into kitchen for it in 18th century. **Cara Chapel Listed Building Category B; Cara House Listed Building Category C.**	S11
LB11448	NR 64326 48080	Post-Medieval	BOUNDARY WALL (WITH 2 GATE-WAYS), KILCHATTAN BURIAL GROUND WALL. 18th (?) century. Rubble; rounded rubble cope. E. GATE-WAY Late 19th century entrance to Scarlett burial lair. Gothic moulded arch; red sandstone. Cast-iron gate. W. GATE-WAY Late 19th century 2 piers. Ashlar; Pyramidal cap; moulded course. **Listed Building Category C.**	S12
LB13759	NR 64782 48948	Modern	GIGHA AND CARA PARISH CHURCH, CNOCAN A CHIUIL, ARDMENISH. Dated 1923. Plain Romanesque Revival, Nave and Chancel Rubble: gabled slate roofs. Round-headed windows. Gabled porch on S. side. Gabled session-room and Vestry on N. side, Plain interior; date '1923' on Chancel arch. Octagonal font (oldest in Argyll) from St. Catan's Chapel; placed her in 1938. Ecclesiastical, in use as such. The 4th Parish Church. Built at suggestion of Rev. Donald Macfarlane to replace Church (1780) which stood opposite Inn. **Listed Building Category B.**	S13
LB11425	NR 64197 47226	Post-Medieval	GATE-LODGE (WITH GATE-PIERS AND GARDEN WALLS) ACHAMORE ESTATE, MAIN ROAD LODGE Dated 1895. Scottish style. 1 storey. Harled; gabled slate roof. Semi-circular porch; conical roof; date "1895" over window. Gabled additions at both ends. Gate-piers. Harled; ball-finials. Garden-walls. Flanking the drive. Rubble. Listed Building Category B.	S14
GDL00005	NR 6428 4782	Post-Medieval to Modern	ACHAMORE HOUSE, a late 19th century designed landscape hosting a remarkable 20th-century garden and renowned plant collection. **Entry on the Inventory of Gardens and Designed Landscapes.**	S15
15440	164770, 648400	Prehistoric	Cup markings, comprising approximately 15 cups. On the left side of the track to Brae House.	S16

Reference	Grid Reference	Period	Description	No. on Fig 12.3
3041	166920, 638310	Prehistoric	Remains of a carin, in which a cist was found.	S18
3049	166400, 637800	Prehistoric	Stone with one deep cup-mark and six shallower cup-marks.	S19
3056	169960, 636910	Prehistoric	A large cup marked boulder with four plain cups on the upper surface.	S20
3074	167790, 634040	Prehistoric	A cup marked boulder with at least 12 cups.	S21
3076	166850, 630950	Prehistoric	A cup and ring marked stone, although its current location is not known.	S22
3084	166760, 630900	Prehistoric	Location of a cup marked boulder.	S23
3145	164550, 648050	Prehistoric	Recorded location of a cup marked stone, although its current location is not known.	S24
3146	164730, 647850	Prehistoric	Location of a cup marked stone.	S25
3163	169880, 641200	Prehistoric	Cup marked boulder with eight cups.	S27
3437	170500, 636950	Prehistoric	Cup marked stone with seven cups and one ring. It could not be located due to dense vegetation during 1996 survey.	S28
3442	170760, 636990	Prehistoric	Cup marked rock with up to eight cups. It could not be located due to dense vegetation during 1996 survey.	S29
3452	170660, 636970	Prehistoric	Cup marked stone with 25 plain cups. It could not be located during 1996 survey.	S30
3470	172537, 645730	Prehistoric	A large cup marked boulder with at least 65 cups.	S31
3473	172874, 647153	Prehistoric	Cup marked boulder with at least five cups.	S32
3474	172825, 647028	Prehistoric	Cup marked boulder.	S33
3480	172788, 647069	Prehistoric	Cup marked boulder with seven shallow cups.	S34
3483	171989, 645054	Prehistoric	Cup marked boulder with at least nine cup marks.	S35
3484	172871, 647201	Prehistoric	Cup marked boulder with at least five cups.	S36
3485	172894, 647219	Prehistoric	Cup marked boulder with six very shallow cups.	S37
58785	167790, 634030	Prehistoric	Cup marked boulder.	S39
LB12035		Post-Medieval	Kilchenzie Parish Church, A' Chleit. **Listed Building Category A.**	S40

RWE

Clachaig Glen Wind Farm

Environmental Impact Assessment Report

Volume 3

Technical Appendices

Appendix 12.2: Setting Assessment Approach

Appendix 12.2 Setting Assessment Approach

1.1.1. All designated and non-designated assets within a 10 km search area were considered for impacts relating to setting at the request of WoSAS. The Zone of Theoretical Visibility (ZTV) data as shown in Figure 12.3 (EIAR Volume 2b) was utilised to aid the assessment and help to identify areas which would have no visibility of the Proposed Development. Professional judgement was used to assess the assets which fell outside the ZTV to ensure they did not have a setting which included any assets within the ZTV and would therefore have the potential to also experience impacts. No assets that fell outside the ZTV were assessed to have a setting relating to assets within the ZTV and were therefore discounted from the assessment. Therefore, only sites within the ZTV were taken forward for setting assessment. A list of designated assets which fell outside the ZTV can be found in Table 1. Non-designated assets are not included in this table, due to the high number of assets.

Table 1 Designated Assets located outside of the ZTV

Reference No.	Asset
SM3306	Cairnvickuie, cross incised stone NW of. **Scheduled Monument.**
SM3308	Ridh a'Chaibeil, burial ground & cross SE of Tarbert. **Scheduled Monument.**
SM3643	Sunadale, dun 275m NE of. **Scheduled Monument.**
SM2180	Carradale, fort,Kilbrannan Sound. **Scheduled Monument.**
SM2487	Corriechrevie, cairn. **Scheduled Monument.**
SM3185	Ronachan Bay, fort S of. **Scheduled Monument.**
SM3077	Blary, dun ENE of. **Scheduled Monument.**
SM3178	Cleongart, dun SE of. **Scheduled Monument.**
SM3649	Grogport Old Manse, dun 180m ENE of. **Scheduled Monument.**
SM3672	Portrigh Strip, earthwork. **Scheduled Monument.**
SM3645	Saddell Abbey. **Scheduled Monument.**
SM3740	Garvalt, dun 500m SW of. **Scheduled Monument.**
SM3659	Beachmeanach, enclosure 700m ESE of. **Scheduled Monument.**
SM7434	Corputechan, hut circles E of, Kintyre. **Scheduled Monument.**
SM175	Ballochroy, three standing stones & cist 400m NE of. **Scheduled Monument.**
SM251	Crois Mhic Aoidh, standing stone. **Scheduled Monument.**
SM178	Barlea, standing stone & cairn. **Scheduled Monument.**
SM189	Carragh an Talaidh,chambered cairn, Brackley. **Scheduled Monument.**
SM3100	Rudha nan Sgarbh, dun. **Scheduled Monument.**
SM3092	Dun Domhnuill, dun 70m NNE of Seafield. **Scheduled Monument.**
SM3176	Glenacardoch, dun 730m WNW of. **Scheduled Monument.**
SM3291	Red Cove, dun 215m N of Beachmenach. **Scheduled Monument.**
SM3229	Dun an Trinnse, dun 325m NW of Ardailly, Gigha. **Scheduled Monument.**
SM3184	An Dunan, dun 70m SW of Minen. **Scheduled Monument.**
SM3177	Airds Castle, 235m SE of Barncluith, Carradale. **Scheduled Monument.**
SM3030	St John's Church, church, burial ground and carved stones, Killean. **Scheduled Monument.**
344016	Old Watermill, Port An Duin', Gigha.
344660	Killean House.
344661	Northern Range, Farmsteading, Killean Home Farm.
344662	Southern Range, Farmsteading, Killean Home Farm.

Reference No.	Asset
344663	Tigh-Na-Cladaich, Muasdale.
344664	House, Glencreggan.
344665	Glenbarr Abbey.
344666	Dovecot, Barr House.
344667	Burial Ground, Cladh Nam Paitean.
344669	Ballure.
344670	Gortinanane House.
344671	Old Bridge, Muasdale.
344672	Coach House, Bellochantuy.
346064	Killean Home Farmhouse.
346065	Lodge, Killean House.
352401	Cour House.
352434	Saddell Parish Church, Dippen.
352435	Dippen Bridge, Carradale.
352436	Carradale House, Carradale.
352437	Torrisdale Square, Torrisdale.
352438	Torrisdale Castle.
352439	West Wing, The Arch, Torrisdale Castle.
352440	East Wing, The Arch, Torrisdale Castle.
352441	Bridge, Torrisdale Estate, Mull.
352442	Bridge, Torrisdale Castle.
352443	Gate Lodge, Torrisdale Castle.
352444	Torrisdale Bridge.
352448	Grogport Old Manse, Grogport.
389660	Hall, Killean.
389697	South Wing, North Range, The Doll's Houses, Killean.
389698	North Wing, South Range, The Doll's Houses, Killean.
389696	North Wing, North Range, The Doll's Houses, Killean.
389699	South Wing, South Range, The Doll's Houses, Killean.
352441	BRIDGE I, LEPHIN CORRACH BURN, TORRISDALE ESTATE. **Listed Building Category C.**
352401	COUR HOUSE SADDELL. **Listed Building Category A.**
346065	KILLEAN HOUSE, LODGE, GATEPIERS, WING WALLS AND RAILINGS. **Listed Building Category B.**
344660	KILLEAN HOUSE. **Listed Building Category A.**
344664	GLENCREGGAN HOUSE. **Listed Building Category B.**
344667	MACALISTER OF GLENBARR BURIAL ENCLOSURE, CLADH NAM PAITEAN. **Listed Building Category C.**
389660	KILLEAN, FORMER SCHOOL. **Listed Building Category B.**
344661	KILLEAN HOME FARM. **Listed Building Category B.**
344665	BARR HOUSE (GLENBARR ABBEY). **Listed Building Category B.**
344666	BARR DOOCOT. **Listed Building Category C.**
344671	MUASDALE OLD BRIDGE, CLACHAIG WATER. **Listed Building Category C.**
389697	KILLEAN, THE "DOLLS' HOUSES". **Listed Building Category A.**
389698	KILLEAN, THE "DOLLS' HOUSES". **Listed Building Category A.**

Reference No.	Asset
352438	TORRISDALE CASTLE. **Listed Building Category B.**
352443	TORRISDALE GATE-LODGE AND GATEWAY TORRISDALE ESTATE SADDELL - SKIPNESS ROAD. **Listed Building Category B.**
389696	KILLEAN, THE "DOLLS' HOUSES". **Listed Building Category A.**
352434	SADDELL PARISH CHURCH, DIPPEN. **Listed Building Category C.**
352448	GROGPORT HOUSE (GROGPORT OLD MANSE). **Listed Building Category B.**
346064	KILLEAN FARMHOUSE. **Listed Building Category B.**
352439	GATE-HOUSE AND STABLE ('THE ARCH') NEAR TORRESDALE CASTLE. **Listed Building Category B.**
344669	BALLURE HOUSE. **Listed Building Category C.**
344016	OLD WATER-MILL, PORT AN DUIN. **Listed Building Category C.**
352436	CARRADALE HOUSE. **Listed Building Category B.**
352442	BRIDGE II, TORRISDALE ESTATE. **Listed Building Category C.**
344670	GORTINANANE HOUSE. **Listed Building Category C.**
352437	TORRISDALE SQUARE. **Listed Building Category B.**
352444	TORRISDALE BRIDGE TORRISDALE WATER SADDELL - SKIPNESS ROAD.
344659	KILLEAN CHAPEL (ST JOHN'S) KILLEAN BURIAL GROUND. **Listed Building Category A.**
344662	KILLEAN HOME FARM. **Listed Building Category B.**
344663	GATE-HOUSE AND STABLE ('THE ARCH') NEAR TORRESDALE CASTLE.
389699	BALLURE HOUSE. **Listed Building Category A.**
352435	OLD WATER-MILL, PORT AN DUIN. **Listed Building Category B.**
352440	CARRADALE HOUSE. **Listed Building Category B.**
344672	BRIDGE II, TORRISDALE ESTATE. **Listed Building Category C.**

1.1.2. Sites that fell within the ZTV were further examined and only assets where setting contributed to their significance were taken forward for full setting assessment. It was also determined at this stage that there would be several assets not affected by the Proposed Development despite appearing to fall within the ZTV. These were also discounted at this stage. A list of sites can be found in Table 2.

Table 2 Assets Discounted from Setting Assessment

Reference No.	Asset	Justification for discounting from assessment
259	Inscribed stone NE of Cnoc na Carraigh. **Scheduled Monument.**	Stone has been knocked down and was re-erected in a different location, close to its original setting. As it is no longer located in its original setting, the setting of the stone no longer contributes to its significance.
SM3179	Killean,fort NE of. **Scheduled Monument.**	Only slight view of one turbine and any key views to sea. Furthermore limited views as in woodland.
344014	GIGHA, ACHAMORE HOUSE, FARM STEADING **Listed Building Category B.**	Setting does not contribute to the asset's significance.
344038	ACHAMORE ESTATE, GATEWAY **Listed Building Category B.**	Setting does not contribute to the asset's significance.
344015	GIGHA, MANSE **Listed Building Category B.**	Setting does not contribute to the asset's significance.
3062	Bellochantuy,dun **Scheduled Monument**	Setting does not contribute to the asset's significance.
3315	Dun a'Bhuic,dun SW of Cleongart **Scheduled Monument**	Setting does not contribute to the asset's significance.
190	Carragh an Tarbert,standing stone 550m NNE of Tarbert,Gigha **Scheduled Monument**	Setting does not contribute to the asset's significance.
3111	An Dunan,dun,WSW of Auchadaduie **Scheduled Monument**	Setting does not contribute to the asset's significance.
3182	Carn Ban,cairn Gigha **Scheduled Monument**	Setting does not contribute to the asset's significance.
3817	Talatoll, shielings 1400m SE of, Kintyre **Scheduled Monument**	Setting does not contribute to the asset's significance.
12927	Ard Share (possible).	Setting does not contribute to the asset's significance.
14206	Shieling-huts.	Setting does not contribute to the asset's significance.
14206	Shieling-huts.	Setting does not contribute to the asset's significance.
15563	Enclosure; Rig.	Setting does not contribute to the asset's significance.
21250	Shieling-huts; Head-dyke; Annexe (possible).	Setting does not contribute to the asset's significance.
21250	Shieling-huts; Head-dyke; Annexe (possible).	Setting does not contribute to the asset's significance.
3168	Stone Macehead.	Setting does not contribute to the asset's significance.
3177	Enclosure.	Setting does not contribute to the asset's significance.

Reference No.	Asset	Justification for discounting from assessment
3476	Shieling-huts.	Setting does not contribute to the asset's significance.
3490	Gold Armlet.	Setting does not contribute to the asset's significance.
3497	Enclosure.	Setting does not contribute to the asset's significance.
3499	Shieling-huts.	Setting does not contribute to the asset's significance.
3500	Shieling-huts.	Setting does not contribute to the asset's significance.
3502	Shieling-huts.	Setting does not contribute to the asset's significance.
3504	Shieling-huts.	Setting does not contribute to the asset's significance.
3507	Barbed-and-tanged Flint Arrowhead.	Setting does not contribute to the asset's significance.
3509	House.	Setting does not contribute to the asset's significance.
43180	Farmstead.	Setting does not contribute to the asset's significance.
43181	Farmstead.	Setting does not contribute to the asset's significance.
43247	Industrial; Limekiln.	Setting does not contribute to the asset's significance.
43249	Quarry.	Setting does not contribute to the asset's significance.
43250	Quarry.	Setting does not contribute to the asset's significance.
43251	Quarry.	Setting does not contribute to the asset's significance.
43252	Quarry.	Setting does not contribute to the asset's significance.
43253	Quarry.	Setting does not contribute to the asset's significance.
45052	Farmstead.	Setting does not contribute to the asset's significance.
45053	Industrial; Farmstead; Limekiln.	Setting does not contribute to the asset's significance.
45056	Farmstead; Head-dyke.	Setting does not contribute to the asset's significance.
51610	Ford.	Setting does not contribute to the asset's significance.
51611	Track.	Setting does not contribute to the asset's significance.
51614	Structure.	Setting does not contribute to the asset's significance.
51615	Drystone structure.	Setting does not contribute to the asset's significance.
58769	Shieling.	Setting does not contribute to the asset's significance.
58773	Shieling.	Setting does not contribute to the asset's significance.
58774	Shieling.	Setting does not contribute to the asset's significance.
58776	Shieling.	Setting does not contribute to the asset's significance.
58777	Shieling.	Setting does not contribute to the asset's significance.
58780	Shieling.	Setting does not contribute to the asset's significance.
58935	Aircraft.	Setting does not contribute to the asset's significance.
59086	Sheepfold.	Setting does not contribute to the asset's significance.
59087	Shieling.	Setting does not contribute to the asset's significance.
59088	Enclosure.	Setting does not contribute to the asset's significance.
59089	Croft; Settlement.	Setting does not contribute to the asset's significance.
59090	Croft.	Setting does not contribute to the asset's significance.
59091	Lithic Find spot.	Setting does not contribute to the asset's significance.
59092	Sheepfold.	Setting does not contribute to the asset's significance.
59093	Find spot.	Setting does not contribute to the asset's significance.
59245	Sheiling.	Setting does not contribute to the asset's significance.
59246	Sheiling.	Setting does not contribute to the asset's significance.
59344	Enclosure.	Setting does not contribute to the asset's significance.
59503	Corn Drying Kiln.	Setting does not contribute to the asset's significance.
62884	Limekiln.	Setting does not contribute to the asset's significance.
62886	Farmstead.	Setting does not contribute to the asset's significance.
62891	Limekiln.	Setting does not contribute to the asset's significance.

Reference No.	Asset	Justification for discounting from assessment
3149	Standing Stone.	The standing stone is not thought to be historic in nature.
3449	Hut-circles.	Setting does not contribute to the asset's significance.
3492	Hut-circle.	Setting does not contribute to the asset's significance.
3503	Hut-circle (possible).	Setting does not contribute to the asset's significance.
51638	Summit Cairns.	Setting does not contribute to the asset's significance.
51639	Summit Cairn.	Setting does not contribute to the asset's significance.
51640	Summit Cairn.	Setting does not contribute to the asset's significance.
58349	Cairn.	Setting does not contribute to the asset's significance.
58358	Cairn.	Setting does not contribute to the asset's significance.
58779	Cairn.	Setting does not contribute to the asset's significance.
58939	Cairn.	Setting does not contribute to the asset's significance.
12927	Cnoc na Seilg Ard Share (possible)	Setting does not contribute to the asset's significance.
14206	Clachaig Water sheiling huts	Setting does not contribute to the asset's significance.
15563	Lagloskine / Largie Estate, Kintyre. Enclosure; Rig	Setting does not contribute to the asset's significance.
21250	Allt na Creige Shieling-huts; Head-dyke; Annexe (possible)	Setting does not contribute to the asset's significance.
3168	North Crubasdale Stone Macehead	Setting does not contribute to the asset's significance.
3177	Low Clachaig enclosure	Setting does not contribute to the asset's significance.
11920	Loch Dirigadale Sheiling-huts	Setting does not contribute to the asset's significance.
11919	Loch Dirigadale Sheiling-huts	Setting does not contribute to the asset's significance.
11918	Loch Dirigadale Sheiling-huts	Setting does not contribute to the asset's significance.
11916	Loch Dirigadale Sheiling-huts	Setting does not contribute to the asset's significance.
11923	Loch Dirigadale Sheiling-huts	Setting does not contribute to the asset's significance.
11915	Loch Dirigadale Sheiling-huts	Setting does not contribute to the asset's significance.
11914	Loch Dirigadale Sheiling-huts	Setting does not contribute to the asset's significance.
11917	Loch Dirigadale Sheiling-huts	Setting does not contribute to the asset's significance.
11924	Loch Dirigadale Sheiling-huts	Setting does not contribute to the asset's significance.
11921	Loch Dirigadale Sheiling-huts	Setting does not contribute to the asset's significance.
11922	Loch Dirigadale Sheiling-huts	Setting does not contribute to the asset's significance.
3490	Braids Gold Armlet	Setting does not contribute to the asset's significance.
3497	Achaglass enclosure	Setting does not contribute to the asset's significance.
3499	Achaglass Sheiling-huts	Setting does not contribute to the asset's significance.
3500	Achaglass Sheiling-huts	Setting does not contribute to the asset's significance.
3502	Achaglass Sheiling-huts	Setting does not contribute to the asset's significance.
3504	Clachaig Water Sheiling-huts	Setting does not contribute to the asset's significance.
3507	Achaglass Barbed and tanged flint arrowhead	Setting does not contribute to the asset's significance.
3509	High Clachaig House	Setting does not contribute to the asset's significance.
43180	High Clachaig farmstead	Setting does not contribute to the asset's significance.
43181	Low Clachaig farmstead	Setting does not contribute to the asset's significance.
43247	Braids, Limekiln	Setting does not contribute to the asset's significance.
43249	Cruach Na Naich quarry	Setting does not contribute to the asset's significance.
43250	Cruach Na Naich quarry	Setting does not contribute to the asset's significance.
43251	Allt Chaltuinn quarry	Setting does not contribute to the asset's significance.

Reference No.	Asset	Justification for discounting from assessment
43252	Cruach A'bhodaidh quarry	Setting does not contribute to the asset's significance.
43253	Cruach A'bhodaidh quarry	Setting does not contribute to the asset's significance.
45052	Killean Burn farmstead	Setting does not contribute to the asset's significance.
45053	Killean Burn Industrial; Farmstead; Limekiln	Setting does not contribute to the asset's significance.
45056	Achaglass / Achahoirk Farmstead; Head-dyke	Setting does not contribute to the asset's significance.
51593	Arinanuan Sheiling-huts	Setting does not contribute to the asset's significance.
51610	Arinanuan ford	Setting does not contribute to the asset's significance.
51611	Arinanaun track	Setting does not contribute to the asset's significance.
51614	Arinanuan structure	Setting does not contribute to the asset's significance.
51615	Arinanuan drystone structure	Setting does not contribute to the asset's significance.
58769	Achaglass Sheiling	Setting does not contribute to the asset's significance.
58773	Allt Mhor Sheiling	Setting does not contribute to the asset's significance.
58774	Allt Mhor Sheiling	Setting does not contribute to the asset's significance.
58776	Chachaig Water Sheiling	Setting does not contribute to the asset's significance.
58777	Chachaig Water Sheiling	Setting does not contribute to the asset's significance.
58780	Cruach Mhic an T-Saoir Sheiling	Setting does not contribute to the asset's significance.
58935	High Clachaig Aircraft	Setting does not contribute to the asset's significance.
59086	High Clachaig sheepfold	Setting does not contribute to the asset's significance.
59087	High Clachaig Shieling	Setting does not contribute to the asset's significance.
59088	High Clachaig enclosure	Setting does not contribute to the asset's significance.
59089	Achahoirk croft; settlement	Setting does not contribute to the asset's significance.
59090	Achaglass croft	Setting does not contribute to the asset's significance.
59091	High Clachaig lithic findspot	Setting does not contribute to the asset's significance.
59092	Achaglass sheepfold	Setting does not contribute to the asset's significance.
59093	Allt Mhor findspot	Setting does not contribute to the asset's significance.
59245	Clachaig Water sheiling	Setting does not contribute to the asset's significance.
59246	Clachaig Water sheiling	Setting does not contribute to the asset's significance.
59503	Achaglass corn drying kiln	Setting does not contribute to the asset's significance.
62884	Braids limekiln	Setting does not contribute to the asset's significance.
62886	Braids / Cnoc Odhar Auchaluskin farmstead	Setting does not contribute to the asset's significance.
62891	Braids / Cnoc Odhar Auchaluskin limekiln	Setting does not contribute to the asset's significance.
3109	Tayinloan flint arrowhead	Setting does not contribute to the asset's significance.
3495	Kilmory church (possible)	Setting does not contribute to the asset's significance.
51591	Arinanuan Indeterminate remains - possibly small corn-drying kiln	Setting does not contribute to the asset's significance.

1.1.3. After assessment, including site visits, further sites were discounted as there were no adverse effects on setting identified. These included the Scheduled Monument of an inscribed stone (S5) and a non-designated cup marked stone (S24) which were discounted as they were no longer positioned in their original location. A non-designated cairn (S18) was also discounted, as was the Kilchattan burial ground, boundary wall and gateways (S12) and the carved stone (S7).

1.1.4. A list of assets taken forward for setting assessment can be found in Table 3.

Table 3 Assets for Setting Assessment

Reference	Grid Reference	Period	Description	No. on Fig 12.3
SM4352	NR 704 403	Prehistoric	The boulder, which is now split, bears cup and ring marks on both halves. The larger part measures 2.4m by 2.1m and bears 54 cupmarks up to 0.1m in diameter and 0.38m deep. Three cups have single rings round them and three have double rings. Two pairs of cups are joined by short channels. The smaller half measures 2.4m by 1.5m and bears thirty-nine cupmarks, six of which are surrounded by incomplete rings. The marks are somewhat weathered. Kintyre contains one of the heaviest concentrations of cup and ring markings in Scotland. Most of them are on boulders on the hills overlooking the west coast. Within this spread there are occasional concentrations. In the concentration around Low Clachaig the boulders lie on the sides of small valleys to the north of the split boulder, and to the south they lie on a west-pointing shoulder of ground. In all, eight boulders are known, in an area measuring roughly 4km by 1km and triangular in shape with its point to the south. **Scheduled Monument.**	1
SM3223	NR 690 402	Prehistoric	Prehistoric domestic and defensive: dun. **Scheduled Monument.**	2
58775	169800, 641200	Prehistoric	Cup marked boulder.	5
3505	171010, 641876	Prehistoric	Cup marked rock which may be weathered examples.	6
3511	170965, 642012	Prehistoric	Cup marked boulder with at least 30 cups.	8
3512	171099, 642125	Prehistoric	Cup marked boulder with at least 17 cups.	9
58770	170800, 642000	Prehistoric	Cup marked boulder.	12
58771	171000, 641800	Prehistoric	Cup marked boulder.	14
58772	171200, 642200	Prehistoric	Cup marked boulder.	13
58778	172200, 642100	Prehistoric	Cup marked boulder.	64
3513	172244, 642173	Prehistoric	Two cup marked boulders with six cups on one and 14 on the other.	66
3513	172254, 642160	Prehistoric	Two cup marked boulders with six cups on one and 14 on the other.	67
15558	171650, 644750	Prehistoric	Cup markings, eight on the southern face and seven on the eastern and top face of a boulder.	99
3451	170182, 639661	Prehistoric	Location of two cup marked boulder.	114
3182	169760, 640590	Prehistoric	Cup marked stone beside a gatepost bearing 12 cups.	119
3155	169600, 640280	Prehistoric	Cup marked stone near a water tank. During the construction of the tank, the stone was overturned so the cups are no longer visible.	120
3154	169480, 640340	Prehistoric	A small stone with four plain cup marks which has been incorporated into the south corner of Low Clachaig barn.	121
3156	169380, 640320	Prehistoric	Cup marked stone, although nothing surviving in the location. A naturally depressed stone may be the one originally recorded.	122
3162	168680, 640400	Prehistoric	A cup marked boulder bearing 15 cups.	125
3180	169290, 641930	Prehistoric	Cup marked boulder with at least 13 cups.	127
3508	171800, 644600	Prehistoric	Cup marked stone with over 20 cups.	142
3454	170108, 639202	Prehistoric	Cup marked boulder with six very shallow cups.	143
3447	170220, 639910	Prehistoric	Location of a cup marked boulder.	144
3494	171458, 643892 171465, 643898	Prehistoric	Cup marked stone with at least 10 cups. The second stone has three cups.	153
3501	171768, 644420	Prehistoric	Cup and ring markings on a large flat boulder with an unusual combination of designs including a horse shoe figure, two rayed circles and a design resembling an asterisk.	155
3501	171767, 644397	Prehistoric	Cup and ring markings on a large flat boulder with an unusual combination of designs including a horse shoe figure, two rayed circles and a design resembling an asterisk.	154
3506	171681, 644469	Prehistoric	Cup marked rock outcrop with at least 12 cups.	156
53240	171787, 644419	Prehistoric	Cup marked boulder.	158
SM13295, 3181	NR 691 420	Prehistoric	The monument comprises an earthfast monolith and two rock outcrops in close proximity, all decorated with prehistoric rock art motifs. The motifs were carved probably during the early prehistoric period, between about 3500 BC and 2500 BC. The monolith now serves as the N side of a gateway between two pasture fields. It measures roughly 0.9m wide by 0.3m deep at its base, but tapers towards the top. It stands 1.5m high and now leans at an angle of 45 degrees, with the decorated surface facing SW. Over 50 cup-marks and variations of cup-mark designs have been recorded. The two outcrops are visible at ground level as small areas of exposed rock surface within pasture land. The easternmost is 1.5m long by 0.9m wide and is decorated with at least 12 cup-marks. The visible area of the second outcrop, 120m to the W, measures 1.2m by 1.2m and is decorated with at least eight cup-marks. The monolith and rock outcrops are located on the S and N sides respectively of the Allt Achapharick burn at approximately 120m above sea level. The former has a predominantly E-facing outlook to the Kintyre ridge, while the two rock outcrops are on the W-facing shoulder of the ridge,	163

Reference	Grid Reference	Period	Description	No. on Fig 12.3
			overlooking the Sound of Gigha, Jura and Islay beyond. The scheduled area comprises three separate circles, centred on the monolith and rock outcrops respectively. The first, 5m in diameter, is centred on the monolith; the second, 8m in diameter, is centred on the westernmost rock outcrop; and the third, 6m in diameter, is centred on the easternmost rock outcrop. The area to be scheduled includes the remains described above and an area around them within which evidence relating to the monument's construction, use and abandonment may survive, as shown in red on the accompanying map. Specifically excluded from the scheduling are the above-ground components of a post-and-wire fence adjacent to the monolith. The monolith may not be in its original position, but it retains significant intrinsic value because of the relatively good condition of the carved motifs and the overall design represented. Antiquarian accounts suggest it has not been disturbed since at least the 1930s. The unusual design includes: single cup-marks; kidney-shaped carvings formed from small groups of cup-marks; a single cup-mark with a concentric, crescent-shaped channel or part-ring; small groups of cup-marks joined by carved channels; and twin cup-marked designs joined by a single channel to form 'dumb-bell' shapes. The motifs appear to be spatially discrete, with few if any overlapping. The cups are between 35mm and 76mm in diameter and up to 19mm deep. The two ground-level rock outcrops are decorated with single cup-marks of around the same dimensions. Again, the individual cups are spatially discrete and do not overlap with each other. Despite the vulnerable position of the outcrops at ground level and the location of the monolith at the side of a gateway, all of the carvings are in good condition. Excavations at similar outcropping sites in Argyll have uncovered further buried carvings and associated remains beyond the footprint of the visible panel, including further carvings, artefacts and environmental evidence. This may also be the case here. Any surviving remains associated with the carvings could help us understand the circumstances behind their creation and how the carved panels were used, as well as provide evidence for the nature of the local environment and vegetation at the time the carvings were produced. In the case of all three panels, any development sequence or phasing of the carvings is difficult to determine because most of the components respect each other spatially. Collectively, however, they represent a significant undertaking by the person or people who carved these designs. As well as their high intrinsic value as decorated monuments, these carved panels can enhance our understanding of the carving process and techniques, the relationship between individual motifs and the overall designs, and the meaning and symbolism of the various motifs and designs. **Scheduled Monument.**	
SM3228	NR 652 497	Prehistoric	Prehistoric domestic and defensive: dun. **Scheduled Monument.**	S1
SM3280	NR 665 347	Prehistoric	Prehistoric domestic and defensive: dun. **Scheduled Monument.**	S2
SM3226	NR 673 386	Prehistoric	Prehistoric domestic and defensive: dun. **Scheduled Monument.**	S3
SM3397	NR 630 482	Prehistoric	Prehistoric ritual and funerary: cairn (type uncertain). **Scheduled Monument.**	S4
SM259	NR 642 481		Crosses and carved stones: inscribed stone. **Scheduled Monument.**	S5
SM188	NR 678 391	Prehistoric	Prehistoric ritual and funerary: standing stone. **Scheduled Monument.**	S6
SM3307	NR 643 481		Achamore House, old parish church. **Scheduled Monument.**	S7
SM3227	NR 649 506	Prehistoric	Dunan an t-Seasgain, dun 465m WNW of Drumyeonmore Farm, Gigha. The monument comprises a prehistoric dun likely to date to the Iron Age (between 500 BC and AD 500). The dun is visible as a sub-oval enclosure sited on the summit of an isolated rocky knoll in the island of Gigha, at a height of 45m above sea level. Overall the dun measures approximately 35m by 24m. The dun is located inland, towards the centre of the island, but has extensive views over the sea channel E of Gigha and beyond, to the Kintyre peninsula. The monument was first scheduled in 1972, but the documentation does not meet modern standards: the present rescheduling rectifies this. The area to be scheduled is an irregular polygon on plan, to include the remains described above and an area around them within which evidence relating to the monument's construction, use and abandonment may survive, and adjoining land essential for the monument's support and preservation, as shown in red on the accompanying map. The scheduling extends up to but does not include the post-and-wire fence to the N of the knoll. **Scheduled Monument.**	S8
SM3230	NR 645 500	Prehistoric	Dun Chibhich, fort 400m NW of Druimyeonbeg, Gigha. The fort survives in a stable and relatively good condition, in an area of rough grazing. It takes advantage of the natural defence offered by near-vertical rock faces around its northern end and very steep drops to the W and E. The only easy approach is from the SW. This natural defence is enhanced by a sub-oval, outer wall around the fort's southern circuit. The enclosure wall remains an impressive and substantial feature. It stands more than 1m in height and is over 3m wide in places. There is a well-defined entrance, 1.5m wide, in the SE part of the wall circuit, with a step or threshold at the mouth of the entrance passage. Most of the walling is obscured by vegetation, but in places the lower courses are visible. Vegetation also obscures the remains of any buildings and structures surviving in the interior, although a sunken court measuring 13.5m by 7.5m has been recorded previously, immediately inside the entrance. This fort is of particular interest because of its larger than usual size and, consequently, the possible variety of functions it performed for its prehistoric builders and occupants. Elsewhere, similar forts have been shown to have a greater time-depth than is obvious from the above-ground remains, sometimes with the discovery of Bronze Age (earlier) and medieval (later) artefacts and structures, as well as different phases of Iron Age use. Dun Chibhich may also have been in use over an extended period.	S9

Reference	Grid Reference	Period	Description	No. on Fig 12.3
			Given the good state of preservation of the enclosing wall and the relative remoteness of the location, it is likely that substantial buried remains may survive here, including buildings and occupation debris. The site has high potential to enhance our understanding of the origins, date, nature and development sequence of large defensive sites in western Scotland. Buried deposits, features and structures can elucidate the economic and agricultural basis of the settlement, provide insights into the contacts and social status of the people who built and occupied the site, and allow us to determine the duration of occupation of the fort. The word 'dun' is commonly applied to smaller defensive structures than Dun Chibhich, typically those less than 20m in diameter, which are likely to have been the homesteads of single families. The classification of Iron Age strongholds in Scotland is an ongoing topic of debate among researchers, but Dun Chibhich is considered to be a fort because of its size. Forts are much less common than duns in western Scotland, representing around 10% of the total number of defensive enclosures. This fort is one of a cluster of five broadly contemporary, but smaller defensive sites in Gigha, all of which are named as duns, including the coastal dun at Dun an Trinnse 930m to the NNW and another dun in the interior of the island, Dunan an t Seasgain, 745m to the NE. Researchers have suggested that the location of forts and duns is significant and that they were deliberately positioned to be intervisible, and were also intended both to be visible from the sea and to command good views out to sea. Dun Chibhich has a prominent position on the island atop one of the highest knolls, from where there are commanding views not only to Islay, Jura and Kintyre to the E, but also across the western and eastern sea channels which flank Gigha. Further study of Dun Chibhich and its function alongside the cluster of smaller duns in Gigha has high potential to enhance our understanding of the date, settlement pattern and use of defensive sites in the later prehistoric period. Dun Chibhich is traditionally said to be the approximate location of a 'giant's grave', that of a local chieftain Kifi who, according to folklore, is buried in a stone enclosure to the S of the fort. A substantial sub-rectangular structure is visible in aerial photographs to the S of the fort, but no recorded archaeological evidence is available for its date or function. **Scheduled Monument.**	
LB11449	NR 64273 47866	Post-Medieval	ACHAMORE HOUSE Dated 1884. John Honeyman. Scottish style. Long, rambling block. 2 storeys. Harled gabled slate roofs. Ashlar chimneys. Semi-circular towers; conical roofs. Crow-steps. Bow and bay windows. Portico with Ionic columns, pilasters, entablature, scroll pediment; panel above with date "1884". Good interiors; Oak panelling. Moulded plaster ceilings Remodelled 1900. Contains English late Gothic stone chimney pieces and mid-Georgian wooden chimney pieces. Built for William Scarlett, 3rd Lord Abinger (who had bought Gigha from the McNeills). Damaged by fire shortly afterwards and restored. Now sub-divided. **Listed Building Category B.**	S10
LB11430	NR 64096 44324	Medieval	CARA CHAPEL (ST. FINLA'S) Oblong chamber. Rubble, partly dilapidated; roofless. Pointed door-way and flat-headed window on N. side. Ruin. Adjoining Cara House and converted into kitchen for it in 18th century. **Cara Chapel Listed Building Category B; Cara House Listed Building Category C.**	S11
LB11448	NR 64326 48080	Post-Medieval	BOUNDARY WALL (WITH 2 GATE-WAYS), KILCHATTAN BURIAL GROUND WALL. 18th (?) century. Rubble; rounded rubble cope. E. GATE-WAY Late 19th century entrance to Scarlett burial lair. Gothic moulded arch; red sandstone. Cast-iron gate. W. GATE-WAY Late 19th century 2 piers. Ashlar; Pyramidal cap; moulded course. **Listed Building Category C.**	S12
LB13759	NR 64782 48948	Modern	GIGHA AND CARA PARISH CHURCH, CNOCAN A CHIUIL, ARDMENISH. Dated 1923. Plain Romanesque Revival, Nave and Chancel Rubble: gabled slate roofs. Round-headed windows. Gabled porch on S. side. Gabled session-room and Vestry on N. side, Plain interior; date '1923' on Chancel arch. Octagonal font (oldest in Argyll) from St. Catan's Chapel; placed her in 1938. Ecclesiastical, in use as such. The 4th Parish Church. Built at suggestion of Rev. Donald Macfarlane to replace Church (1780) which stood opposite Inn. **Listed Building Category B.**	S13
LB11425	NR 64197 47226	Post-Medieval	GATE-LODGE (WITH GATE-PIERS AND GARDEN WALLS) ACHAMORE ESTATE, MAIN ROAD LODGE Dated 1895. Scottish style. 1 storey. Harled; gabled slate roof. Semi-circular porch; conical roof; date "1895" over window. Gabled additions at both ends. Gate-piers. Harled; ball-finials. Garden-walls. Flanking the drive. Rubble. Listed Building Category B.	S14
GDL00005	NR 6428 4782	Post-Medieval to Modern	ACHAMORE HOUSE, a late 19th century designed landscape hosting a remarkable 20th-century garden and renowned plant collection. **Entry on the Inventory of Gardens and Designed Landscapes.**	S15
15440	164770, 648400	Prehistoric	Cup markings, comprising approximately 15 cups. On the left side of the track to Brae House.	S16
3041	166920, 638310	Prehistoric	Remains of a carin, in which a cist was found.	S18
3049	166400, 637800	Prehistoric	Stone with one deep cup-mark and six shallower cup-marks.	S19
3056	169960, 636910	Prehistoric	A large cup marked boulder with four plain cups on the upper surface.	S20
3074	167790, 634040	Prehistoric	A cup marked boulder with at least 12 cups.	S21
3076	166850, 630950	Prehistoric	A cup and ring marked stone, although its current location is not known.	S22
3084	166760, 630900	Prehistoric	Location of a cup marked boulder.	S23
3145	164550, 648050	Prehistoric	Recorded location of a cup marked stone, although its current location is not known.	S24

Reference	Grid Reference	Period	Description	No. on Fig 12.3
3146	164730, 647850	Prehistoric	Location of a cup marked stone.	S25
3163	169880, 641200	Prehistoric	Cup marked boulder with eight cups.	S27
3437	170500, 636950	Prehistoric	Cup marked stone with seven cups and one ring. It could not be located due to dense vegetation during 1996 survey.	S28
3442	170760, 636990	Prehistoric	Cup marked rock with up to eight cups. It could not be located due to dense vegetation during 1996 survey.	S29
3452	170660, 636970	Prehistoric	Cup marked stone with 25 plain cups. It could not be located during 1996 survey.	S30
3470	172537, 645730	Prehistoric	A large cup marked boulder with at least 65 cups.	S31
3473	172874, 647153	Prehistoric	Cup marked boulder with at least five cups.	S32
3474	172825, 647028	Prehistoric	Cup marked boulder.	S33
3480	172788, 647069	Prehistoric	Cup marked boulder with seven shallow cups.	S34
3483	171989, 645054	Prehistoric	Cup marked boulder with at least nine cup marks.	S35
3484	172871, 647201	Prehistoric	Cup marked boulder with at least five cups.	S36
3485	172894, 647219	Prehistoric	Cup marked boulder with six very shallow cups.	S37
58785	167790, 634030	Prehistoric	Cup marked boulder.	S39
LB12035		Post-Medieval	Kilchenzie Parish Church, A' Chleit. **Listed Building Category A.**	S40

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Appendix 12.3:

Photos

Appendix 12.3 Photos

Photograph 1: View from the existing access track to be upgraded. Gigha and Islay can be seen in the distance.

Photograph 2: View east along Claichaig Water from the existing bridging point (NR71258 41552) towards Turbines 11 and 13 showing mature plantations.

Photograph 3: View of site including existing access track in northern area near Turbines 2 and 5.

Photograph 4: View of open land within the north western section of the site looking towards Turbine 3.

Photograph 5: Cup marks on rock outcrop identified during the 2021 walkover survey (177).

Photograph 6: View of rock outcrop with cup marks identified during the 2021 walkover survey (177).

Photograph 7: Remains of Achahoirk croft (10 & 11) near Turbine 10.

Photograph 8: Remains of Achahoirk croft (10 & 11) near Turbine 10.

Photograph 9: Remains of shielings recorded near the original access track to Turbine 13 (29-34).

Photograph 10: Remains of shielings recorded near the original access track to Turbine 13 (29-34).

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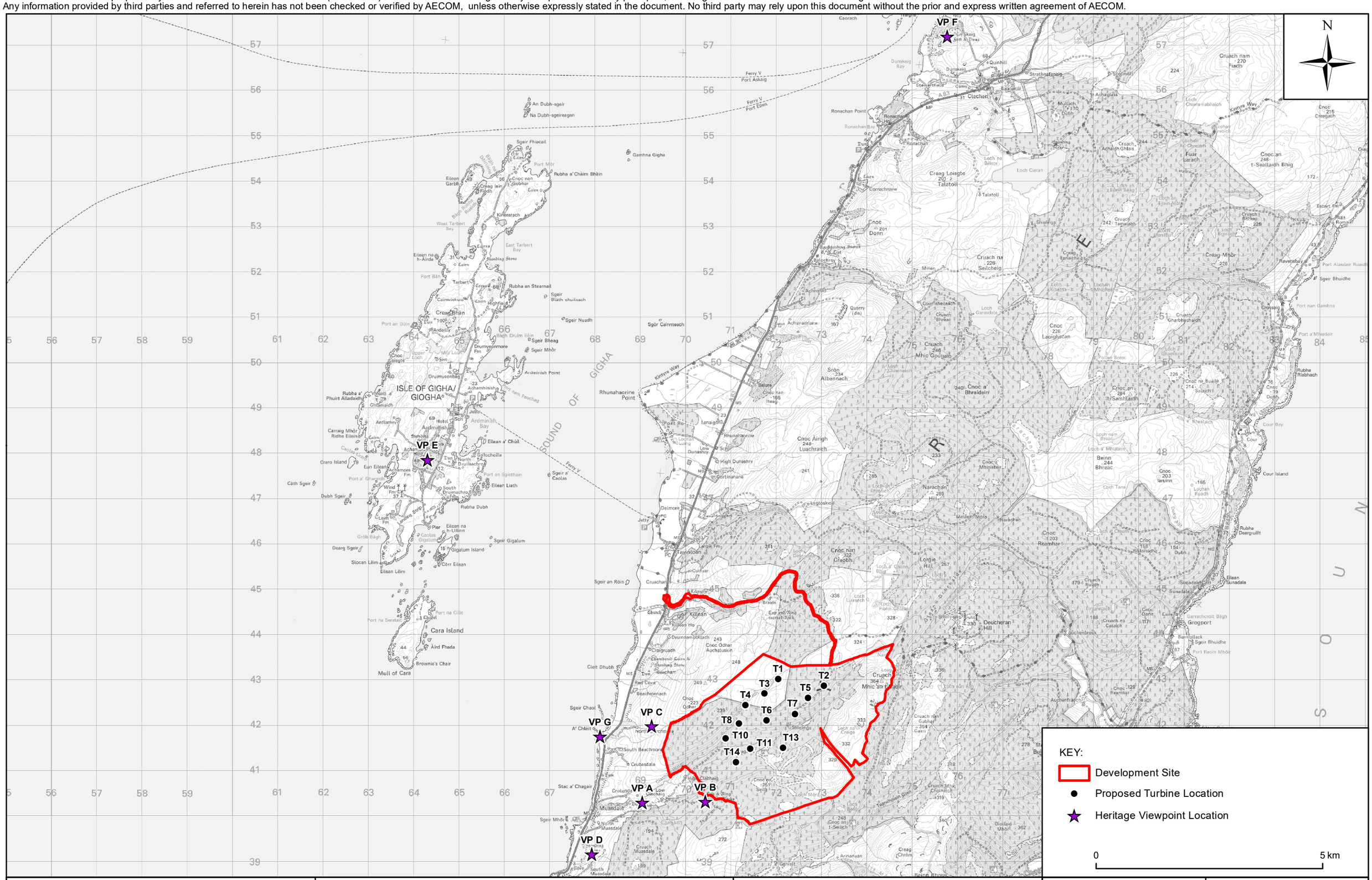
Figure: 12.3.1



Client: RWE	Title: FIGURE 12.3.1 HERITAGE VIEWPOINT LOCATIONS	AECOM One Trinity Gardens Quayside Newcastle, NE1 2HF Tel +44 (0) 191 224 6500 Fax +44 (0) 191 224 6599 www.aecom.com	Drawn: LC / Checked: AR
Project: CLACHAIG GLEN WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT			Verified: GS / Approved: SW
			Date: JANUARY 2022 / Scale at A3: 1:75,000
			Drawing Number: CG_220106_EIA_A12.3.1_v2 / A3

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Appendix 14.1: Indicative Construction Traffic Programme

Appendix 14.1 Indicative Construction Traffic Programme

Activity	Number of 2-way Trips per Month												
	1	2	3	4	5	6	7	8	9	10	11	12	Total
Delivery of aggregate for temporary construction compound etc	240												240
Delivery / removal of plant and equipment for welfare facilities, craneage, civils	1114												1114
Delivery of aggregate for access tracks (new)	1445	1445	1445	1445	1445	1445							8672
Delivery of aggregate for upgrading access tracks (upgraded)	259	259	259	259	259	259							1556
Delivery of geogrid and geofabrics	28	28	28	28	28	28							168
Delivery of aggregate for crane hard standings & anemometry mast			588	588	588	588	588	588	588				4114
Construction of substation and connection to overhead lines			238	238									475
Delivery of materials for cable trench backfill, manholes, ducting etc			321	321	321	321	321	321	321	321			2566
Delivery of ready mixed concrete for foundations of turbines			381	381	381	381	381	381	381				2667
Delivery of ready mixed concrete met masts foundations, Substations and other permanent structures								109	109	109	109		434
Delivery of turbine components (HGV sized Loads)									60	60	60	60	240
Delivery of turbine components (Abnormal Sized Loads)									60	60	60	60	240
Delivery associated with culvert crossings		0											0
Other miscellaneous deliveries (batteries, cables, steelwork, pipe etc.)	139	139	139	139	139	139	139	139	139	139	139	139	1665

Activity	Number of 2-way Trips per Month												
	1	2	3	4	5	6	7	8	9	10	11	12	Total
Total Monthly HGV movements *	3226	1872	3400	3400	3162	3162	1430	1538	1658	690	368	260	24166
Approximate daily HGV movements excluding concrete delivery **	162	94	152	152	140	140	54	54	60	30	14	14	-
Anticipated max daily HGV movement relating to turbine concrete delivery ***			222	222	222	222	222	222	222				-
Average daily movement of construction personnel and non-HGV deliveries	30	30	30	30	30	30	30	30	30	30	30	30	-
TOTAL - Highest daily movements, all vehicles	192	124	182	182	170	170	84	84	90	60	44	44	-
TOTAL - Highest daily movements, HGVs only (excludes concrete delivery)**	162	94	152	152	140	140	54	54	60	30	14	14	-

* HGV movements should be rounded to an equal number (i.e. One movement for vehicle arriving at site and another movement for vehicle leaving site).

** Assuming 20 working days per month and HGV enter and leave the site on the same day. An additional 2 days per month are allotted to the delivery of concrete for turbine foundations only during construction.

*** Assumes one continuous concrete pour per turbine base. Turbine bases constructed over a 7-month period. Therefore, concrete delivery for bases will only occur on 2 days in every month during that construction period (i.e. 14 individual days in total).

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Appendix 15.1: Coordinates Tables

Appendix 15.1 Coordinates Tables

15.1.1 Coordinates tables associated with Chapter 15: Infrastructure and Telecommunications (EIAR Volume 2a) are listed within Table 1 and Table 2.

Table 1 Scoping Report Layout

ID	X	Y	Tip Height (m)	Rotor Diameter (m)
1	172042	643025	180	140
2	173016	642763	180	140
3	171732	642706	180	140
4	171315	642462	180	140
5	172656	642456	180	140
6	171789	642110	180	140
7	172423	642107	180	140
8	171178	642039	180	140
10	170883	641708	180	140
11	171384	641485	180	140
13	171994	641309	180	140
14	171172	641130	180	140

Table 2 Final Layout

ID	Easting	Northing	Tip Height (m)	Rotor Diameter (m)
1	172042	643025	185	155
2	173055	642867	185	155
3	171741	642693	185	155
4	171316	642438	185	155
5	172701	642602	185	155
6	171789	642110	185	155
7	172417	642250	200	155
8	171178	642039	185	155
10	170883	641708	200	155
11	171426	641475	200	155
13	172149	641498	200	155
14	171113	641187	200	155

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Appendix 16.1: Aviation Lighting and Mitigation Report

WPAC
Wind Power Aviation Consultants Ltd

Wind Power Aviation Consultants Ltd

Wind Farm Aviation Lighting and Mitigation Report for Clachaig Glen Wind Farm

Our Reference: WPAC/043/21
Your Reference:
Email tasking J Barnes RWE Renewables/J Devenny AECOM

Authors: Commander John Taylor, RN (Ret)

Squadron Leader Mike Hale MBE MSc CFS RAF (Ret)

Light Modelling, GIS and Mapping – Sam Taylor BA (Hons) MSc

Wind Power Aviation Consultants Ltd, Company No.: 6811887
e-mail: enquiries@wpac.co.uk Tel.: +44 (0)2380767345 Mob.: +44 (0)7949234440
www.wpac.co.uk

Reference Documents

A. Civil Aviation Publication (CAP) 764 Civil Aviation Authority (CAA) Policy and Guidance on Wind Turbines Version 6, Feb 2016
B. CAP 764 Version 7 (Draft) issued for comment in June 2020 (to be released shortly)
C. Air Navigation Order (ANO) Article 222
D. CAA Policy Statement: Lighting of Onshore Wind Turbine Generators in the United Kingdom with a maximum blade tip height at or in excess of 150m Above Ground Level dated 01/06/17
E. NatureScot General pre-application and scoping advice for onshore wind farms dated Sep 2020
F. International Civil Aviation Organisation (ICAO) Annex 14 Vol 1 Chapter 6
G. CAA SARG /Windfarms/Clachaig Glen letter 12 Oct 2020

Scope

1. This report is divided into two parts. Part 1 proposes a lighting design that is compliant with existing and draft (but soon to be ratified) regulations and guidance contained within References A to D and F as discussed with the CAA and the MOD. It explains the rationale behind the lighting design taking into account the requirement to minimise the number of turbines illuminated with aviation obstruction lights whilst maintaining flight safety and provides a detailed assessment of the brilliance of the lighting when viewed from a number of viewpoints provided by the LVIA consultant after consultation with the relevant stakeholders including NatureScot and Argyll and Bute Council. Part 2 of the report identifies and explains those mitigation measures that can be utilised to minimise the environmental effect of the lights including an assessment of the historical meteorological data from which to predict the luminous intensity requirements for the lights. The entire report can be considered to fulfil the requirements for an Aviation Lighting Landscape and Visual Impact Mitigation Plan (ALLVIMP) as proposed by NatureScot in their response to a recent Wind Farm Inquiry.

Part 1 Turbine Lighting Layout Design

Introduction

2. WPAC have designed a number of CAA and MOD compliant lighting layouts for wind farms and have also been in constant dialogue with the CAA regarding the proposed change to CAP 764 in terms of aviation lighting requirements. Whilst Reference A is technically the current publication for policy and guidance on this issue, Reference B was released for comment and is already being used by the CAA as the current de facto policy. Recent discussions with the CAA clarified that the draft regulations will not be changing in terms of the overarching policy but the wording may be slightly amended in the interests of clarity.

Lighting Layout Starting Point and Assumptions

3. After a number of wind farm design iterations and the resultant aviation lighting designs, RWE Renewables has finalised a 12 turbine site design on the Kintyre Peninsula. The site is located in and around the Clachaig Water Glen on the southwest slopes of Cruach Mhic-an t-Saoir. The site has been subject to ongoing change but has now finalized the exact size and location of the proposed turbines. Turbine tip heights are either 180 or 200 metres.

4. The Clachaig Glen site is located in MOD Low Flying Area 14 (LFA 14). This is a large and valuable piece of training airspace which includes Tactical Training Area 14 by day and Night Allocated Region 2B after dark. At night military aircraft use Night Vision Goggles and/or Devices (NVG/D) and it is important that any obstruction lighting fitted to turbines is compatible with these devices, i.e. has an Infra Red (IR) component. The MOD position will be examined in detail later.

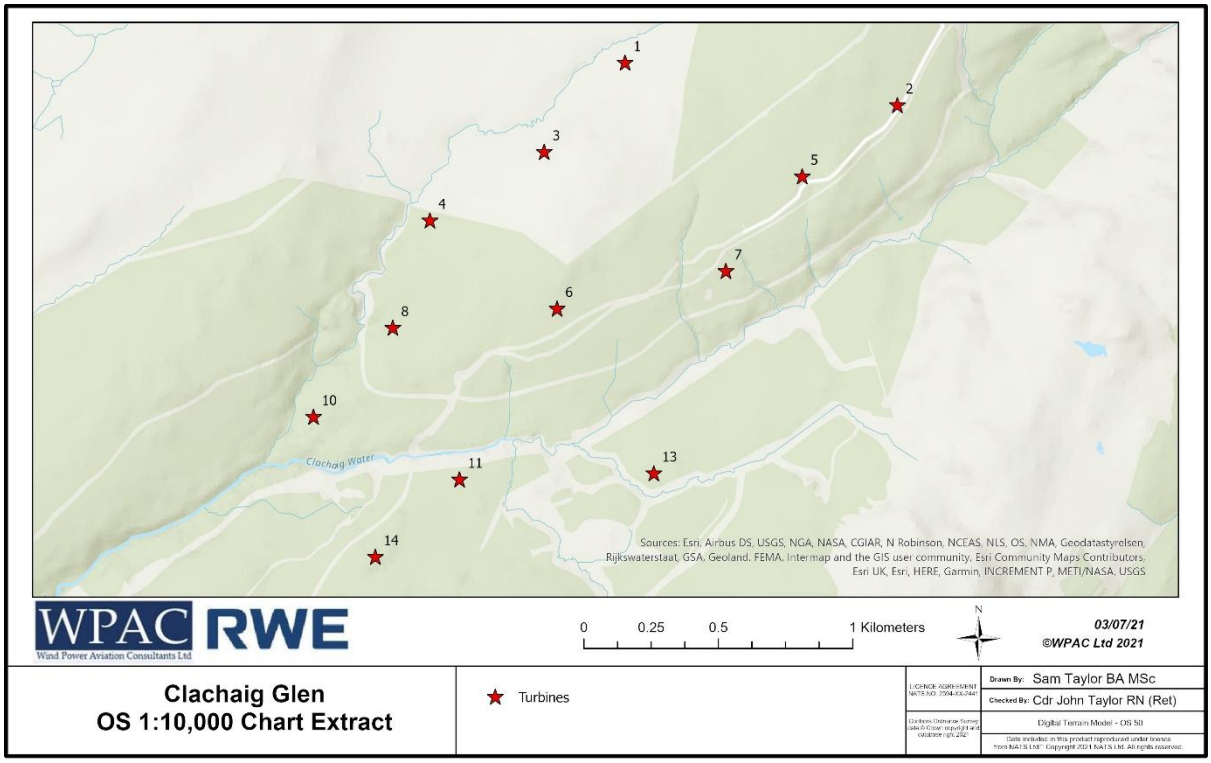

Figure 1: Clachaig Glen

5. The airspace over the site is classified as unregulated Class G airspace insofar as obstruction lighting is concerned in accordance with the most recent (still draft) CAA CAP 764.

   - To accommodate MOD requirements, the site will be assessed for NVG compatible lighting in accordance with MOD published obstruction lighting specifications.

   - Where possible, the recommended lighting configurations will be optimised to reduce light impact on the local area.

- The Clachaig Glen wind turbine proposal is for 12 turbines at 185 and 200 metres to tip as shown in Figures 1 and 6.

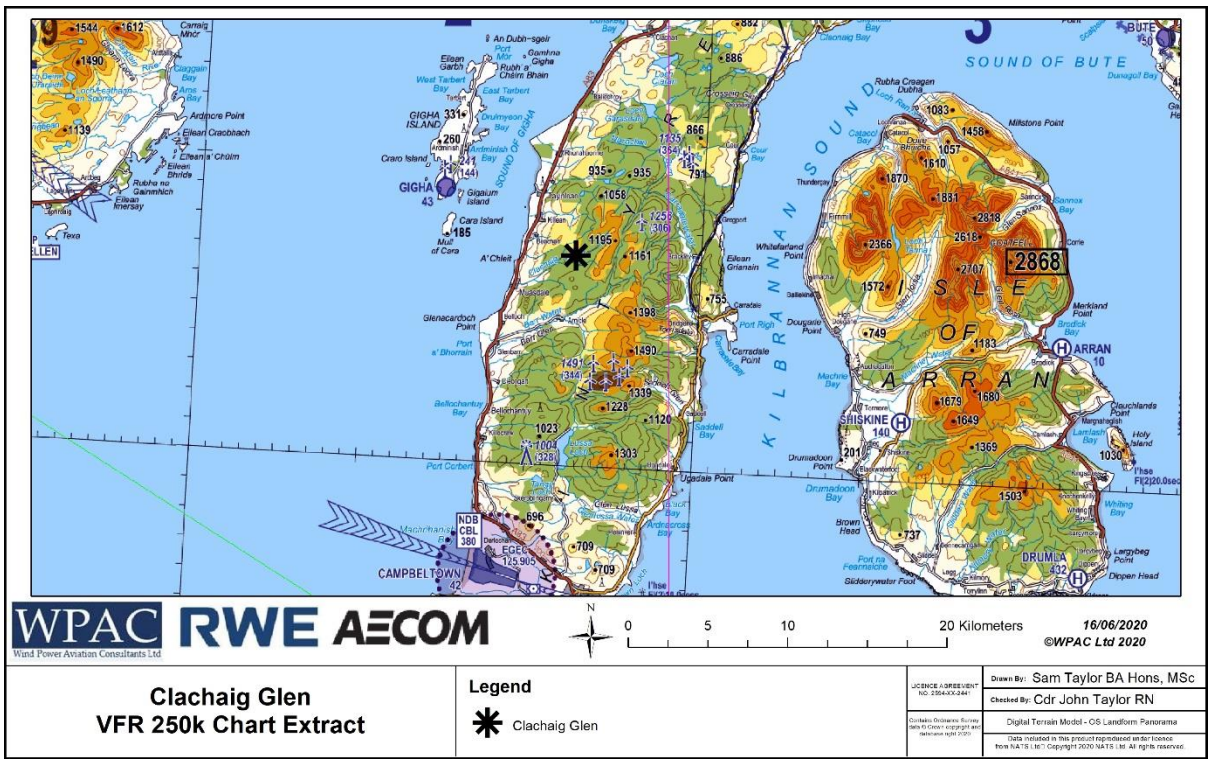

Figure 2 Clachaig Glen showing Campbeltown Airport to the south

CAA-ANO Red 2000/200cd Lighting

6. The CAA requires:

- That all 'string-perimeter' turbines be lit unless removing a light will leave a gap of less than 900m total between the remaining lit turbines.

- That any turbine within 200m of a 'string perimeter' be lit unless the distance between adjacent turbines is less than 900m total.

- That any unlit turbine does not exceed a 10° up-slope from adjacent lit turbines. Note: the highest turbines on the site are lit. Accordingly, not all non-perimeter turbines require lights.

7. Applying these criteria dictates that all of the 'string perimeter' and close set turbines of the Clachaig Glen site will require ANO lighting. Eight turbine hub lights in total.

Turbines with 2000/200cd Lights: T1, T2, T4, T7, T10, T11,13 and T14

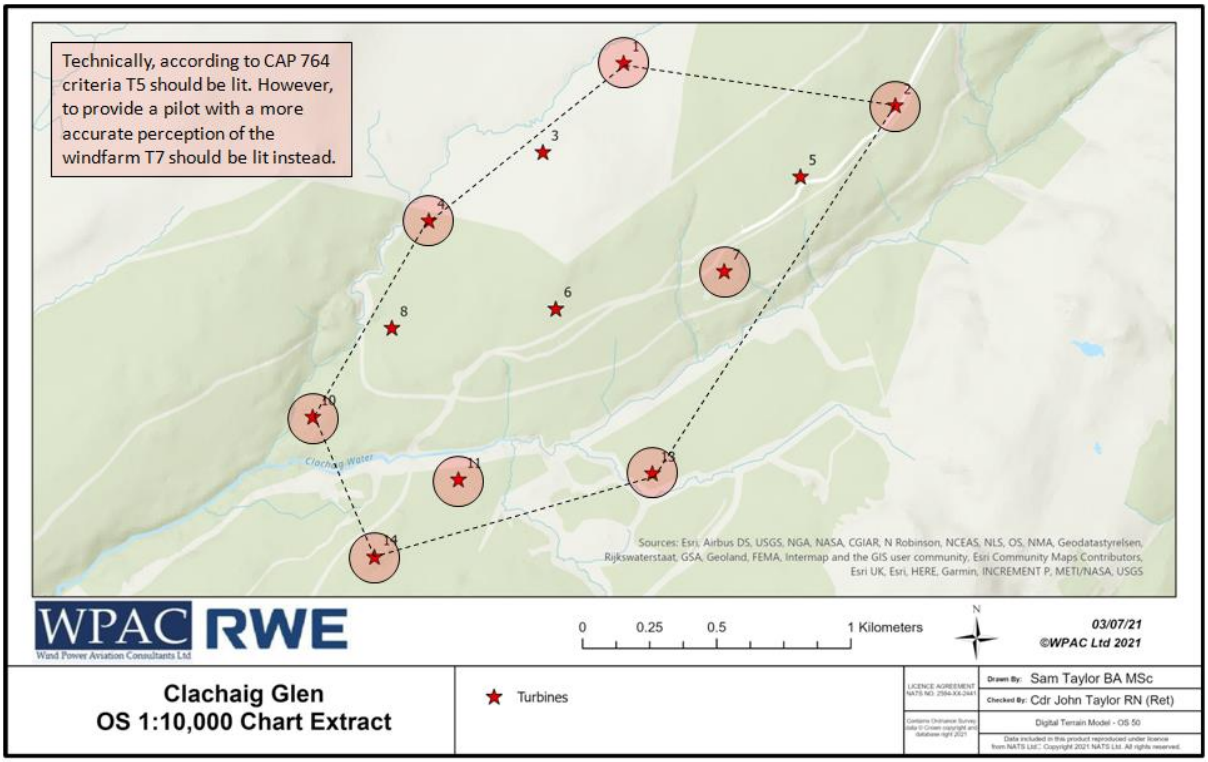

Figure 3 CAA-ANO CAP 764 Compliant Lighting Arrangement

MOD Low Flying & Lighting

8. Military low flying is conducted at various heights by day and at night. Aircraft are fitted with a range of Night Vision Devices (NVDs) and aircrew can also wear Night Vision Goggles. Most of these devices use Infra-Red light (heat) to see objects since heat radiation persists during the hours of darkness.

9. In many circumstances, aircrew using such devices can see wind turbines at night at several miles range - weather (atmospheric heat profile) dependant. Nonetheless, whilst low flying at night, it is important that aircrew can guarantee to see the turbines at 5km range. Fast jets operate up the nine nautical miles per minute: that is 18 kilometres per minute or one kilometre in a little over 3 seconds. Early detection is important especially if the aircraft is manoeuvring hard and the air temperature profile causes the turbines to blend into the background. Suitable lighting is necessary for flight safety.

10. MOD IR lights have been developed to be invisible to the public at large but very detectable to aircrew night vision aids. As such the MOD IR lights can have a wide beam width and flash continuously without disturbing the environment.

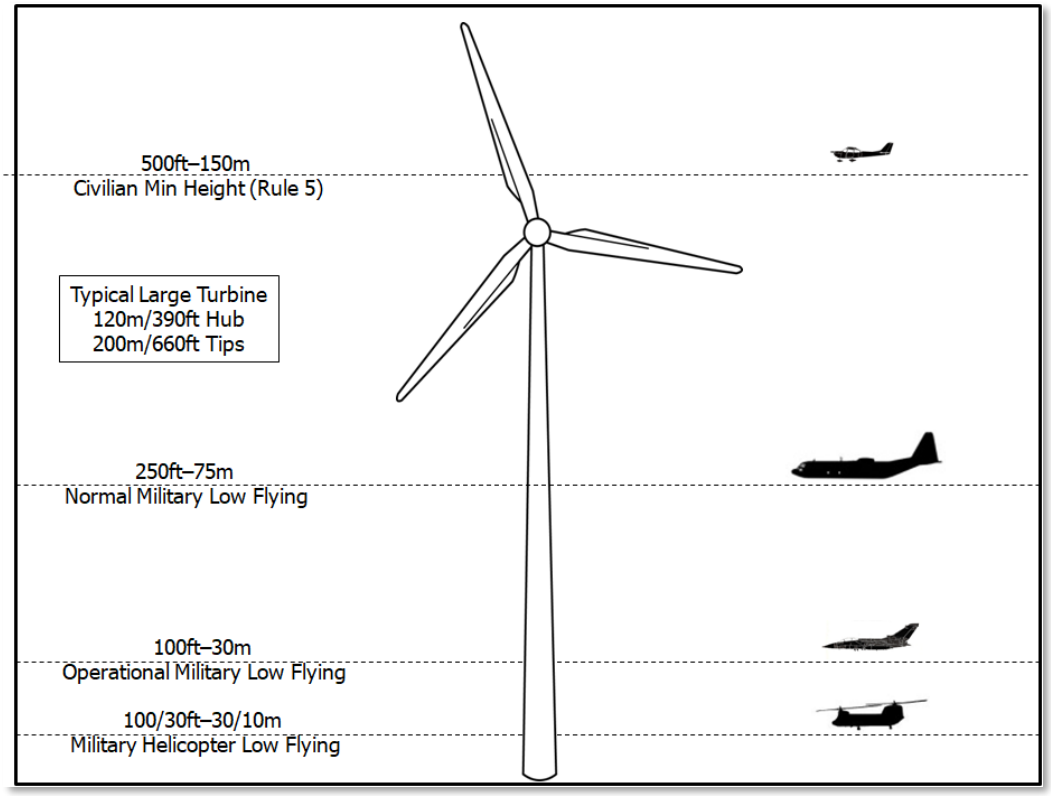

Figure 4 MOD Low Flying Vs Wind turbines in context

MOD IR Lighting

11. The MOD requires:

- That all 'compound-perimeter' (see diagram) turbines be lit unless removing a light will leave a gap of less than 500m between the remaining perimeter lit turbines.
- That any dominant turbine, by location or height, be lit.
- That a central turbine be lit to provide 'depth perception' to approaching aircraft. Note: this does not apply to turbine sites that have a footprint of less than 1 sq nm (approx 4 sq km). Clachaig Glen requires a lit central turbine.

12. Applying these criteria dictates that all of the compound perimeter turbines of the Clachaig Glen site will require IR lighting to each turbine as shown in Figure 7, however in order to reduce NVG gain down as per MOD policy, only eight turbines will be lit with IR hub lights as shown in Figure 5.

Turbines with Infra-Red Lighting: T1, T2, T4, T6, T7, T10, T13, T14.

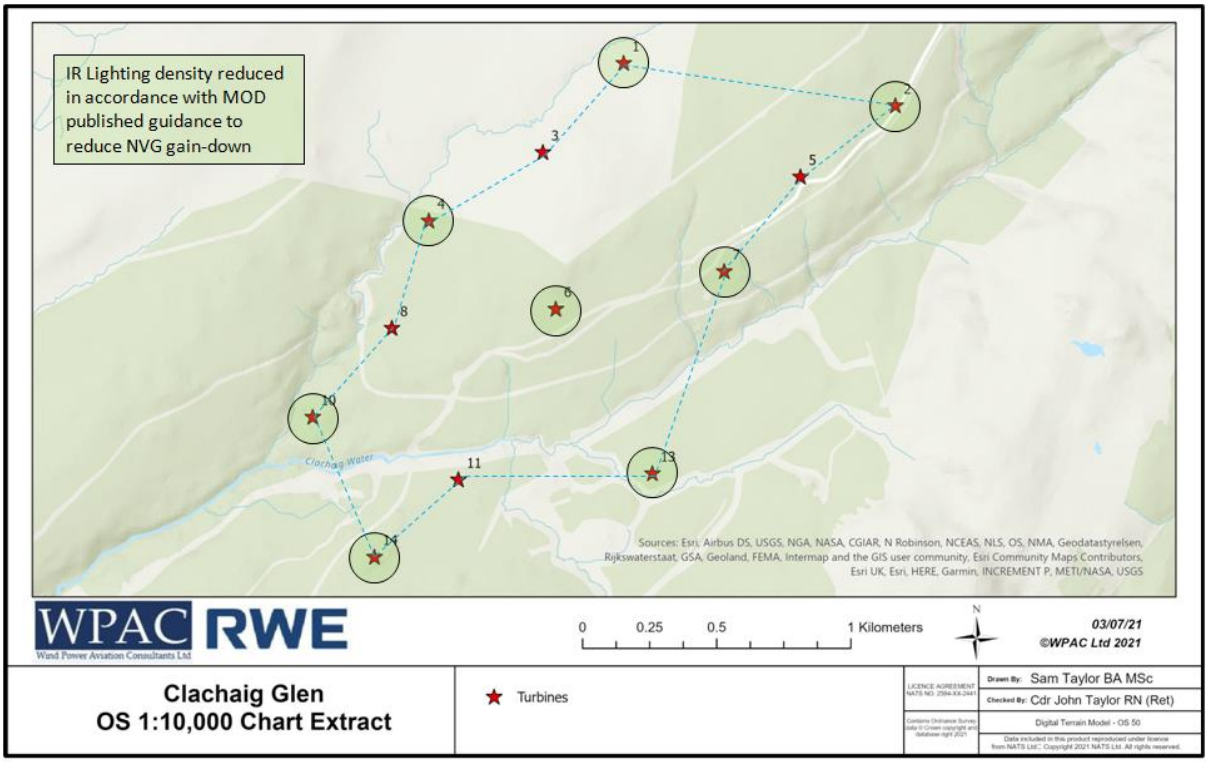

Figure 5 MOD IR Guidance Compliant Lighting Arrangement

Combined CAA Visible Lighting and MOD Infra-Red Lighting

Turbine No	Easting	Northing	Tip Height	ANO Lights	MOD Lights	Mid Mast
1	172042	643025	185	Yes	Yes	
2	173055	642867	185	Yes	Yes	
3	171741	642693	185			
4	171316	642438	185	Yes	Yes	
5	172701	642602	185			
6	171789	642110	185		Yes	
7	172417	642250	200	Yes	Yes	
8	171178	642039	185			
10	170883	641708	200	Yes	Yes	
11	171426	641475	200	Yes		
13	172149	641498	200	Yes	Yes	
14	171113	641187	200	Yes	Yes	

Figure 6: Combined CAA & MOD Lighting Table

13. The CAA were consulted about the proposed lighting layout in Figure 6 based upon the previous layout, which is very similar to the finalised layout and their approval response at Reference G included a concession that there was no requirement for mid-mast lights in this location. The CAA will be re-consulted to confirm that the previously approved lighting design remains largely unchanged but with an additional turbine requiring lighting.

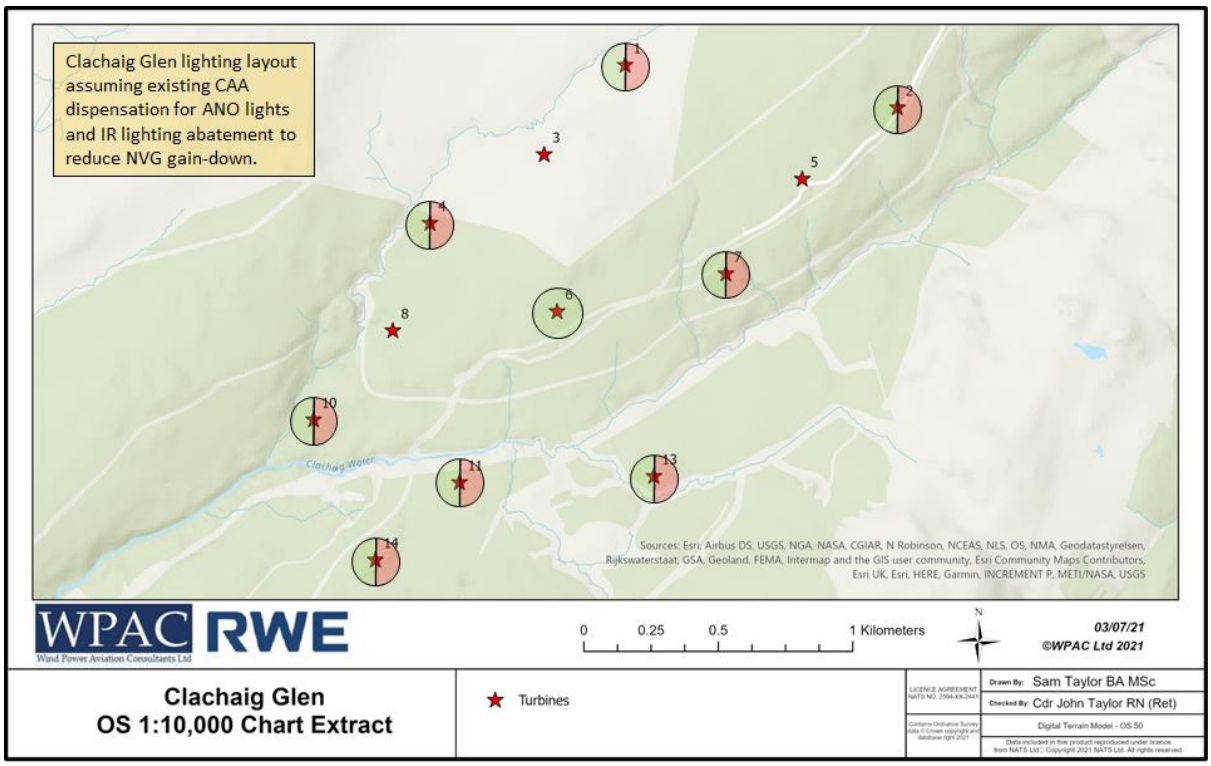

Figure 7 Combined CAA and MOD Lighting Diagram

ANO Light Specifications

14. The ANO 2000/200cd Lights will conform to the ICAO specification as set out in Annex 14 Table 6-3. The lights will also be controlled such that when the met visibility is greater than 5km in all directions from all turbine hubs, the lights will be reduced to 200cd (10% of normal power). This reduction in power will not apply to MOD IR Lights.

ICAO Annex 14 Table 6-3 (excerpt)

Benchmark intensity	Minimum requirements					Recommendations				
	Vertical elevation angle (b)			Vertical beam spread (c)		Vertical elevation angle (b)			Vertical beam spread (c)	
	0°		-1°			0°	-1°	-10°		
	Minimum average intensity (a)	Minimum intensity (a)	Minimum intensity (a)	Minimum beam spread	Intensity (a)	Maximum intensity (a)	Maximum intensity (a)	Maximum intensity (a)	Maximum beam spread	Intensity (a)
2000	2000	1500	750	3°	750	2500	1125	75	N/A	N/A

a) 360° horizontal. All intensities are expressed in Candela. For flashing lights, the intensity is read into effective intensity, as determined in accordance with the Aerodrome Design Manual (Doc 9157), Part 4.
b) Elevation vertical angles are referenced to the horizontal when the light unit is levelled.
c) Beam spread is defined as the angle between the horizontal plane and the directions for which the intensity exceeds that mentioned in the "intensity" column.

Figure 8: ICAO Annex 14 Table 6-3 Medium Intensity Lighting Specifications.

Table 6-2. Light distribution for low-intensity obstacle lights

	Minimum intensity (a)	Maximum intensity (a)	Vertical beam spread (f)	
			Minimum beam spread	Intensity
Type A	10 cd (b)	N/A	10°	5 cd
Type B	32 cd (b)	N/A	10°	16 cd
Type C	40 cd (b)	400 cd	12° (d)	20 cd
Type D	200 cd (c)	400 cd	N/A (e)	N/A

Note.— This table does not include recommended horizontal beam spreads. 6.2.1.3 requires 360° coverage around an obstacle. Therefore, the number of lights needed to meet this requirement will depend on the horizontal beam spreads of each light as well as the shape of the obstacle. Thus, with narrower beam spreads, more lights will be required.

Figure 9: ICAO Annex 14 Table 6-2 Low Intensity Obstacle Lights.

IR Light Specifications

15. The IR lights will conform to the MOD specification as set-out in MOD Lighting Guidance.

MOD Specification IR.

IR wavelength – 750 to 900nm.
But ideally concentrated within 800 to 850nm for optimum detection by all military NVG types.

IR intensity – 600mW/sr minimum at peak flash but not above 1200mW/sr.
(Note: Typically a 300mW/sr steady burn LED IR light will generate 600mW/sr at peak flash)
This will generate a 7-8 nm NVG pick-up range - remaining above 5nm as the light ages.

Horizontal Pattern – unrestricted 360 deg.

Vertical Pattern – Minimum flash intensity of 600 mW/sr between +30 deg and -15 deg elevation.
– up to 50% reduction between +25 to +30 deg and -10 to -15 deg is acceptable.
– Maximum intensity of 1200 mW/sr for all angles of elevation.
– Vertical overspill is acceptable.

Flash Pattern – 60 flashes per min at 100-500 ms duration (ideally 250ms)

Synchronisation – all lights to be visually synchronised across a wind farm site

Figure 10 MOD Specification for IR Obstacle Lights

Assessment of Aviation Lighting and Potential Mitigation Measures Designed into the Lights

16. Having defined a layout of turbines to be lit with visible lighting, an assessment has been undertaken to calculate the brilliance of the lights when seen from a number of viewpoints. The standard aviation lights to be fitted to the nacelle of the turbines are required to fulfil certain design criteria in terms of brilliance and coverage as per Figure 8. They are designated 'medium intensity obstruction lights' and have a minimum luminous intensity of 2000 candela[1] at horizontal and slightly above. The LED lights are also required to be able to shine a beam that reduces in intensity above and below the horizontal also as shown in Figure 8 above. One manufacturer of such obstruction lights, CEL, have tested their light, the CEL MI-2KR[2] in a calibration chamber and produced results showing precisely how much the beam reduces in brilliance at any specified elevation angle. The results are provided to every 0.1°. These lights are already fitted in a number of locations around the UK.

17. Figure 11 demonstrates the reduction in luminous intensity below the horizontal and also above 1° in elevation. The various coloured lines are the candela measured from different angles in the horizontal in order to measure the performance all around the light.

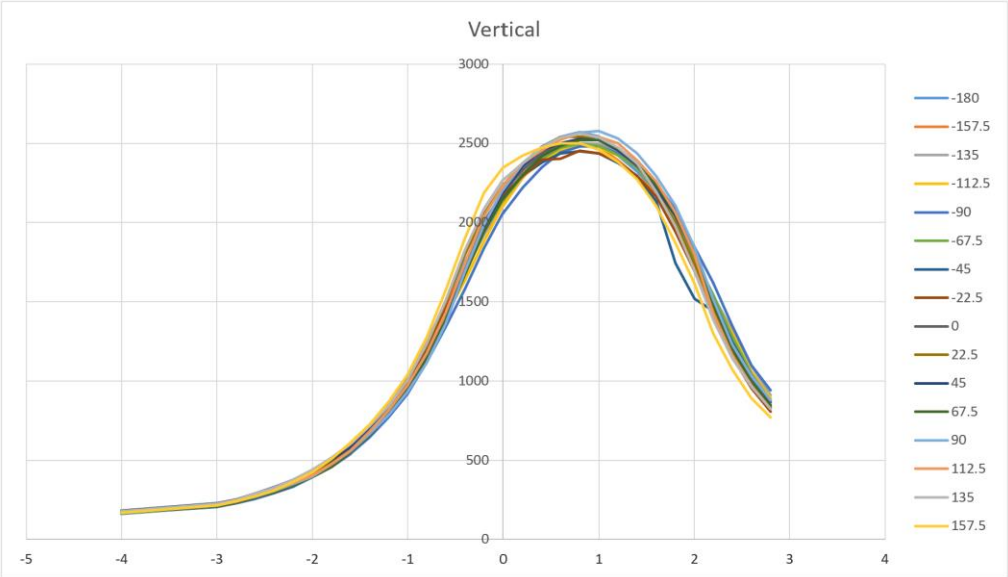

Figure 11 (MI GAM Light Measurement Results)

18. WPAC have utilised their propagation modelling system (Rview) to calculate the precise angle of elevation between the turbine light and a viewpoint assuming a height of eye of 1.5 metres and a turbine hub height of 112 and 132 metres as required. The system utilises a standard atmospheric model and an earth model that uses actual earth curvature between the turbine light and the

[1] Candela is the SI Unit of luminous intensity and refers to the amount of light emitted in a particular direction.

[2] The Technical Specification is at: https://www.contarnex.com/led-obstruction-lighting/medium-intensity-led-obstacle-warning-lighting.php

viewpoint. Ordnance Survey OS50 DTM is used as the terrain model. The calculations have been undertaken for each designated lit turbine against all Clachaig Glen Wind Farm viewpoints. The locations of the viewpoints are shown in Figure 12 and Table 3.

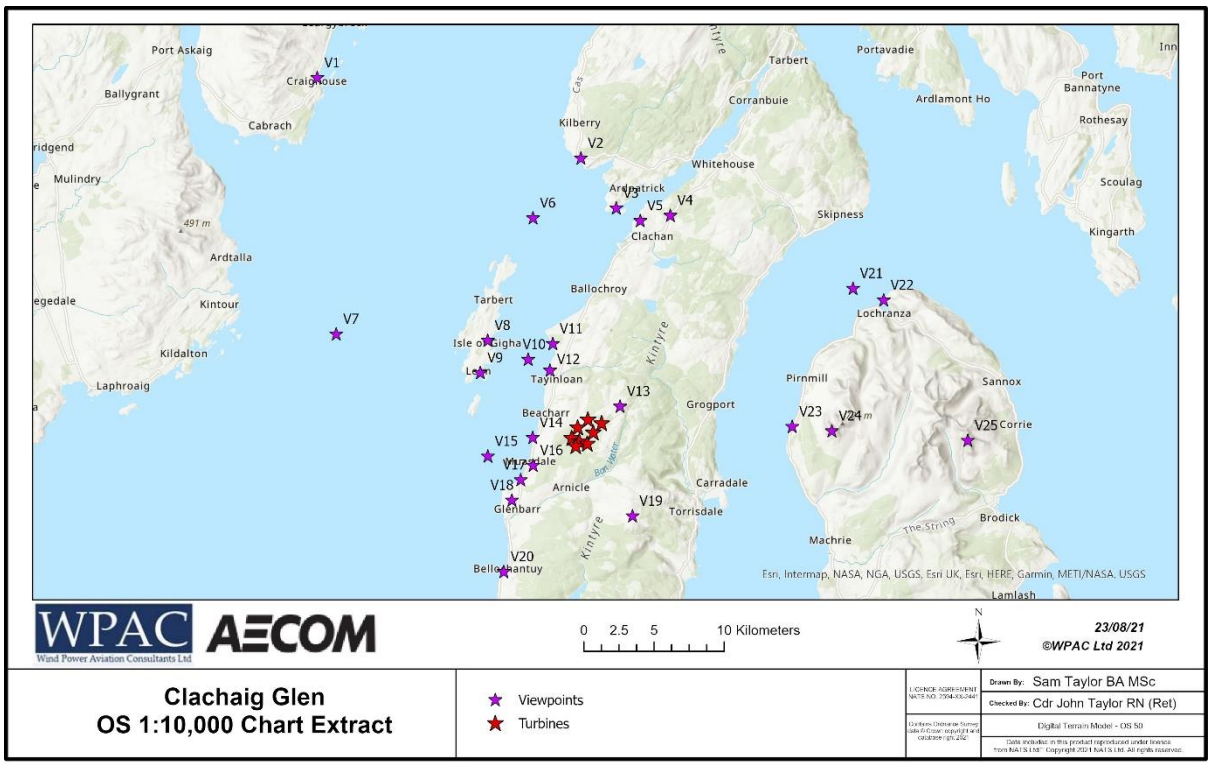

Figure 12 Viewpoint Locations and Lit Turbines

Viewpoint Number	Viewpoint Name	Easting	Northing
1	Craighouse, Jura	152740	667370
2	B8024 south of Kilberry	171541	661638
3	Ardpatrick	174063	658086
4	A83 north of Clachan	177920	657558
5	Dun Skeig	175775	657185
6	Kennacraig - Port Askaig Ferry	168126	657382
7	Kennacraig - Port Ellen Ferry	154091	649118
8	Ardminish, Gigha	164896	648662
9	South Pier, Gigha	164371	646362
10	Sound of Gigha from Gigha Ferry	167781	647310
11	Rhunahaorine/ Point Sands near the caravan park	169539	648433
12	Tayinloan Ferry Terminal	169336	646531
13	Kintyre Way north of site	174336	643968
14	A'Chleit	168106	641746
15	Sound of Gigha from recreational watercraft	164905	640419
16	North Muasdale	168136	639771

17	A83 south of Muasdale	167248	638737
18	Glenacardoch	166619	637287
19	Beinn an Tuirc	175223	636169
20	A83 near Bellochantuy	166040	632191
21	Lochranza - Claonaig Ferry	190950	652364
22	Newton Point, Arran	193137	651538
23	A841 Whitefarland, Arran	186613	642531
24	Beinn Bharrain, Arran	189439	642218
25	Goatfell, Arran	199135	641538

Table 3 Viewpoints

19. The next stage in the process is to take the candela figures radiated towards a viewpoint and taking into account the distance, calculate the lumens per square metre that will be experienced by the human eye at the viewpoint. The figure produced is in micro-lumens per square metre or lumen(10^{-6})/m^2). These are perfect clear-air figures and therefore are worst case results from an LVIA perspective. Figures obtained by this method enable comparisons to be made with commonly understood light sources such as stars or planets. In practice the light intensity at the observation points will be further attenuated by scatter and absorption by airborne dust, droplets and aerosols in the atmosphere. This attenuation is typically in the order of 10 to 20% can be as high as 75% at the more distant observation ranges. The results for all of the lit turbines are shown in the following tables. **Viewpoints where lights are obstructed by terrain are shaded in green, when the viewpoint is too close to a turbine to get an accurate assessment it is shaded red. To take into account any inaccuracies within the terrain model we have highlighted in purple any viewpoints where the line of sight is under 5 metres above ground level but above 1.5 metres and should therefore, still be screened by terrain.**

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	31.068	-0.8	1105	110.5	1.1	0.1	
2	31.829	-0.8	1105	110.5	1.1	0.1	
4	31.091	-0.7	1231	123.1	1.3	0.1	
7	31.909	-0.8	1105	110.5	1.1	0.1	
10	31.428	-0.6	1357	135.7	1.4	0.1	
11	31.933	-0.6	1317	132.0	1.0	0.1	
13	32.343	-0.7	1231	123.1	1.2	0.1	
14	31.986	-0.7	1231	123.1	1.2	0.1	

Viewpoint 1 Craighouse, Jura

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	18.62	-1.0	982	98	2.8	0.28	
2	18.83	-1.1	902	90	2.5	0.25	
4	19.20	-0.9	1087	109	2.9	0.29	
7	19.41	-1.0	982	98	2.6	0.26	
10	19.94	-0.8	1192	119	3.0	0.30	
11	20.163	-0.8	1192	119	2.9	0.3	
13	20.15	-0.9	1087	109	2.7	0.27	
14	20.46	-0.8	1192	119	2.8	0.28	

Viewpoint 2 B8024 south of Kilberry

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	15.196	-1.294					x
2	15.252	-1.429					x
4	15.887	-1.116					x
7	15.921	-1.079					x
10	16.684	-0.824					x
11	16.819	-0.454					x
13	16.698	-0.734					x
14	17.155	-0.729					x

Viewpoint 3 Ardpatrick

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	15.68	-0.9	1087	109	4.4	0.44	
2	15.48	-1.1	902	90	3.8	0.38	
4	16.50	-0.8	1192	119	4.4	0.44	
7	16.27	-0.9					
10	17.34	-0.6					
11	17.345	0.2					
13	17.07	0.0					
14	17.73	-0.4					

Viewpoint 4 A83 north of Clachan

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	14.644	-0.9	999	99.9	4.7	0.5	
2	14.574	-1.0	894	89.4	4.2	0.4	
4	15.406	-0.7	1231	123.1	5.2	0.5	
7	15.308	-0.9	999	99.9	4.3	0.4	
10	16.232	-0.5					x
11	16.301	-0.4					x
13	16.101	-0.4					x
14	16.663	-0.6					x

Viewpoint 5 Dun Skeig

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Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	14.881	-1.4	617	61.7	2.8	0.3	
2	15.329	-1.5	566	56.6	2.4	0.2	
4	15.281	-1.2	736	73.6	3.2	0.3	
7	15.729	-1.4	617	61.7	2.5	0.2	
10	15.915	-1.1	815	81.5	3.2	0.3	
11	16.246	-1.1	902	90.0	3.4	0.3	
13	16.386	-1.2	736	73.6	2.7	0.3	
14	16.468	-1.1	815	81.5	3.0	0.3	

Viewpoint 6 Kennacraig – Port Askaig Ferry

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	18.957	-1.1	815	81.5	2.3	0.2	
2	19.968	-1.2	736	73.6	1.8	0.2	
4	18.475	-1.0	894	89.4	2.6	0.3	
7	19.571	-1.1	815	81.5	2.1	0.2	
10	18.354	-1.0	894	89.4	2.7	0.3	
11	18.945	-1.0	982	98.2	2.7	0.3	
13	19.6	-1.0	894	89.4	2.3	0.2	
14	18.779	-1.0	894	89.4	2.5	0.3	

Viewpoint 7 Kennacraig – Port Ellen Ferry

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	9.1	-2.3	333	33	4	0.4	
2	10.01	-2.2	357	36	3.6	0.36	
4	8.94	-2	413	41	5.2	0.52	
7	9.88	-2.1	385	39	3.9	0.39	
10	9.18	-1.8	484	48	5.7	0.57	
11	9.711	-1.8	484	48.4	5.1	0.5	
13	10.19	-1.8	484	48	4.7	0.47	
14	9.72	-1.8	484	48	5.1	0.51	

Viewpoint 8 Ardminish Gigha

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	8.365	-2.5	267	26.7	3.8	0.4	
2	9.361	-2.4	281	28.1	3.2	0.3	
4	7.977	-2.3	301	30.1	4.7	0.5	
7	9.036	-2.4	281	28.1	3.4	0.3	
10	8.004	-2.1	346	34.6	5.4	0.5	
11	8.582	-1.9	385	38.5	5.2	0.5	
13	9.174	-2.1	346	34.6	4.1	0.4	
14	8.499	-2.1	346	34.6	4.8	0.5	

Viewpoint 9 South Pier, Gigha

Hazards, 38 Hadrian Way, Chilworth, Southampton SO16 7HX

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	6.04	-3.4	199	20	5.4	0.54	
2	6.90	-3.2	208	21	4.4	0.44	
4	6.02	-3.0	217	22	6.0	0.60	
7	6.86	-3.1	213	21	4.5	0.45	
10	6.40	-2.6	273	27	6.7	0.67	
11	6.88	-1.9					X
13	7.27	-2.2					X
14	6.97	-2.4					X

Viewpoint 10 South of Gigha from Gigha Ferry

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	5.95	-3.5	194	19	5.5	0.55	
2	6.58	-3.0					X
4	6.24	-2.9	228	23	5.9	0.59	
7	6.81	-3.0					X
10	6.85	-2.1					X
11	7.198	-1.5					X
13	7.40	-2.2					X
14	7.40	-1.8					X

Viewpoint 11 Rhunahaorine/Point Sands near Caravan Park

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	4.43	-4.6	116	12	5.9	0.59	
2	5.22	-4.0					X
4	4.55	-2.9					X
7	5.27	-3.7					X
10	5.07	-2.1					X
11	5.471	-1.9					X
13	5.77	-1.8					X
14	5.63	-1.9					X

Viewpoint 12 Tayinloan Ferry Terminal

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	2.48	-1.1	902	90	146.7	14.67	
2	1.69	-2.6	273	27	95.6	9.57	
4	3.39	0.0	2185	219	190.1	19.07	M
7	2.58	-1.3	756	76	113.6	11.39	
10	4.13	0.3	2379	238	139.5	13.97	
11	3.832	0.1	2257	226	153.7	15.4	
13	3.30	-0.2	1982	198	182.0	18.21	
14	4.26	0.0	2185	219	120.4	12.06	

Viewpoint 13 Kintyre Way, north of site

Hazards, 38 Hadrian Way, Chilworth, Southampton SO16 7HX

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	4.139	-3.848					x
2	5.074	-3.468					x
4	3.284	-5.1					x
7	4.34	-3.999					x
10	2.777	-5.815	80	8	10	1	M
11	3.331	-3.398					x
13	4.051	-3.358					x
14	3.059	-5.205					x

Viewpoint 14 A'Chleit

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	7.60	-2.7	254	25	4.4	0.44	
2	8.51	-2.6	273	27	3.8	0.38	
4	6.72	-2.7	254	25	5.6	0.56	
7	7.73	-2.8	239	24	4.0	0.40	
10	6.12	-2.8	239	24	6.4	0.64	
11	6.606	-2.6	273	27	6.3	0.6	
13	7.32	-2.6	273	27	5.1	0.51	
14	6.26	-2.8	239	24	6.1	0.61	

Viewpoint 15 Sound of Gigha from Recreational Watercraft

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	5.08	-3.5	194	19	7.5	0.75	
2	5.81	-3.3	204	20	6.0	0.60	
4	4.15	-3.7	185	19	10.7	1.07	
7	4.95	-3.7	185	19	7.6	0.76	
10	3.36	-4.1	150	15	13.3	1.33	
11	3.705	-3.9	176	18	12.8	1.3	
13	4.37	-3.6	190	19	10.0	1.00	
14	3.30	-4.4	122	12	11.2	1.12	

Viewpoint 16 North Muasdale

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	6.43	-3.0					X
2	7.12	-2.8					X
4	5.50	-3.1					X
7	6.25	-3.0					X
10	4.69	-3.3					X
11	4.994	-3.0					X
13	5.62	-2.4					X
14	4.58	-3.4					X

Viewpoint 17 A83 South of Muasdale

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	7.90	-2.2	357	36	5.7	0.57	
2	8.52	-2.1					X
4	6.97	-2.2	357	36	7.3	0.73	
7	7.64	-2.2					X
10	6.15	-2.3	333	33	8.8	0.88	
11	6.38	-2.0					X
13	6.96	-1.9					X
14	5.95	-2.3					X

Viewpoint 18 Glenacardoch

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	7.56	0.6	2475	248	43.3	4.33	
2	7.04	0.4	2429	243	49.0	4.90	
4	7.39	1.0	2503	250	45.9	4.59	
7	6.70	0.6	2475	248	55.2	5.52	
10	7.04	1.2	2439	244	49.2	4.92	
11	6.525	1.2	2439	245	57.3	5.70	
13	6.15	1.1	2471	247	65.3	6.53	
14	6.49	1.2	2439	244	58.0	5.80	

Viewpoint 19 Bienn an Tuirc

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	12.39	-1.6					X
2	12.77	-1.6					X
4	11.53	-1.5	622	62	4.7	0.47	M
7	11.91	-1.6					X
10	10.68	-1.5	622	62	5.5	0.55	M
11	10.733	-1.5					X
13	11.13	-1.4					X
14	10.33	-1.6					X

Viewpoint 20 A83 near Bellochantuy

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	21.089	-0.7					x
2	20.259	-1.2	736	73.6	2	0.2	
4	22	0.0					x
7	21.113	-0.6					x
10	22.721	0.6					x
11	22.355	0.7					x
13	21.715	0.4					x
14	22.769	0.8					x

Viewpoint 21 Lochranza Claonaig Ferry

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Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	22.748	-0.9					x
2	21.874	-1.1	815	81.5	2	0.2	M
4	23.642	-0.1					x
7	22.707	-0.8					x
10	24.328	0.5					x
11	23.93	1.1					x
13	23.266	0.1					x
14	24.335	0.5					x

Viewpoint 22 Newton Point Arran

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	14.579	0.1					x
2	13.562	-1.6	515	51.5	2.8	0.3	
4	15.297	0.1					x
7	14.199	-0.9					x
10	15.752	0.7					x
11	15.224	0.7					x
13	14.501	0.3					x
14	15.558	0.4					x

Viewpoint 23 A841 Whitefarland, Arran

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	17.416	1.1	2953	295.3	9.7	1	
2	16.397	1.1	2953	295.3	11	1.1	
4	18.124	1.2	2963	296.3	9	0.9	
7	17.022	1.1	2953	295.3	10.2	1	
10	18.563	1.2	2963	296.3	8.6	0.9	
11	18.028	1.2	2439	243.9	7.5	0.8	
13	17.305	1.2	2963	296.3	9.9	1	
14	18.355	1.2	2963	296.3	8.8	0.9	

Viewpoint 24 Beinn Bharrain, Arran

Turbine	Distance	Elevation	Candela	Candela at 10%	Microlumens	Microlumens at 10%	Obscured
1	27.134	1.0	2941	294.1	4.0	0.4	
2	26.114	0.9	2917	291.7	4.3	0.4	
4	27.834	1.0	2941	294.1	3.8	0.4	
7	26.727	1.0	2941	294.1	4.1	0.4	
10	28.253	1.1	2953	295.3	3.7	0.4	
11	27.709	1.1	2471	247.1	3.2	0.3	
13	26.986	1.0	2941	294.1	4.0	0.4	
14	28.024	1.0	2941	294.1	3.7	0.4	

Viewpoint 25 Goatfell, Arran

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Interpreting the Results

20. The results show that there is a significant decrease in the luminous intensity (candela) of the light emanating towards those viewpoints which are at lower angles of elevation in relation to the turbine hub. However, when considering the perception of the light from a viewpoint, the distance between the light and the viewpoint is the dominant factor and the resultant figure in micro-lumens is the most relevant figure to consider. This report provides the results and anticipates that the Landscape and Visual Impact Assessment (LVIA) consultants will be able to put them into the correct context for visualisations in terms of background environmental lighting and atmospheric conditions. Table 4 shows the turbine with the greatest potential perceived luminous intensity expressed in micro-lumens at each viewpoint.

Viewpoint	Turbine	Microlumens	Microlumens at 10%	Obscured
1	10	1.4	0.14	
2	10	3.0	0.3	
3	X			x
4	1	4.4	0.4	
5	4	5.2	0.5	
6	11	3.4	0.3	
7	10	2.8	0.3	
8	10	5.7	0.6	
9	11	5.5	0.6	
10	10	6.7	0.7	
11	4	5.9	0.6	
12	1	5.9	0.6	
13	13	182.1	18.2	
14	X			x
15	11	6.7	0.7	
16	11	13.8	1.4	
17	X			x
18	10	8.8	0.9	
19	13	65.3	6.5	
20	X			x
21	2	2.0	0.2	
22	x			x
23	2	2.8	0.3	
24	2	11.0	1.1	
25	2	4.3	0.4	

Table 4 Brightest Turbine Hub Light from each Viewpoint (measured in micro-lumens)

21. In order to place the values in microlumens in context, Table 5 provides some examples of approximate values placed on a number of environmental comparators, however these are just an illustration to place the results in context. The actual perceived brightness will depend upon a number of factors including bulb manufacturer, bulb type, specific construction (single/multiple colour LEDs etc) atmospheric conditions, absorption spectrum, individual eye characteristics and capabilities.

Comparison Object	Approximate Illuminance (micro-lumens per m²)
Car Halogen main beam approaching 1km	Up to 1,000,000 (can vary significantly between cars)
International Space Station (400km up)	1000 (depends upon relative position of sun)
Car Brake Light at 0.5km	400
Car Brake Light at 0.7km	200
Car Brake Light at 1.0km	100
Car Brake Light at 2.0km	25
Car Brake Light at 5.0km	4
Car Brake Light at 10km	1
Front Cycle Light at 0.5/0.7/1/2/5km	140 (Modern high power white LED)
Front Cycle Light at	70
Front Cycle Light at	35
Front Cycle Light at	9
Front Cycle Light at	2
White LED Street Light at 0.5km	500 (Viewed from the horizontal)
White LED Street Light at 0.7km	250
White LED Street Light at 1.0km	120
White LED Street Light at 2.0km	30
White LED Street Light at 5.0km	8
Sodium Street Light at 0.5/0.7/1/2/5km	300 (Viewed from the horizontal)
Sodium Street Light at 0.7km	150
Sodium Street Light at 1.0km	75
Sodium Street Light at 2.0km	20
Sodium Street Light at 5.0km	5
Brightest Star in the Sky (Sirius)	13
Airliner flying at 30,000ft)	Nav Lights 0.4 to 5; anti-collision lights 2 to 20
Typical bright star (e.g. Orion)	0.5 to 2.0
Faintest light visible from street lit area	0.4
Visible limit for fully dark-adapted eyes	0.02

Table 5 Comparisons of micro-lumens values

22. If there is a requirement to consider the brightest turbine in terms of emitted candela rather than micro-lumens, Table 6 provides data on which turbine emits the most candela towards each viewpoint but takes no account of distance between light and viewpoint.

Viewpoint	Turbine	Candela	Candela at 10%	Obscured
1	10	1357	136	
2	10	1192	119	
3	X			x
4	4	119	11	
5	4	1231	123	
6	11	902	90.2	
7	11	982	98.2	
8	10	484	48	
9	11	403	40	
10	10	273	27	
11	4	228	23	
12	1	116	17	
13	11	2452	245	
14	x			x
15	11	291	29	
16	2	204	20	
17	x			x
18	11	357	36	
19	2	2503	25	
20	x			x
21	2	736	74	
22	x			x
23	2	515	52	
24	13	2963	297	
25	10	2953	295	

Table 6 Brightest Turbine Hub Light measured in Candela emitted towards a viewpoint

NB – where candela results are the same, the closest turbine has been selected as the brightest.

Part 2 Mitigation

23. The lights (IR and ANO) will be switched on between Evening Civil Twilight and Morning Civil Twilight in accordance with the UK Almanac. Approximately 11 hours per day averaged over the year.

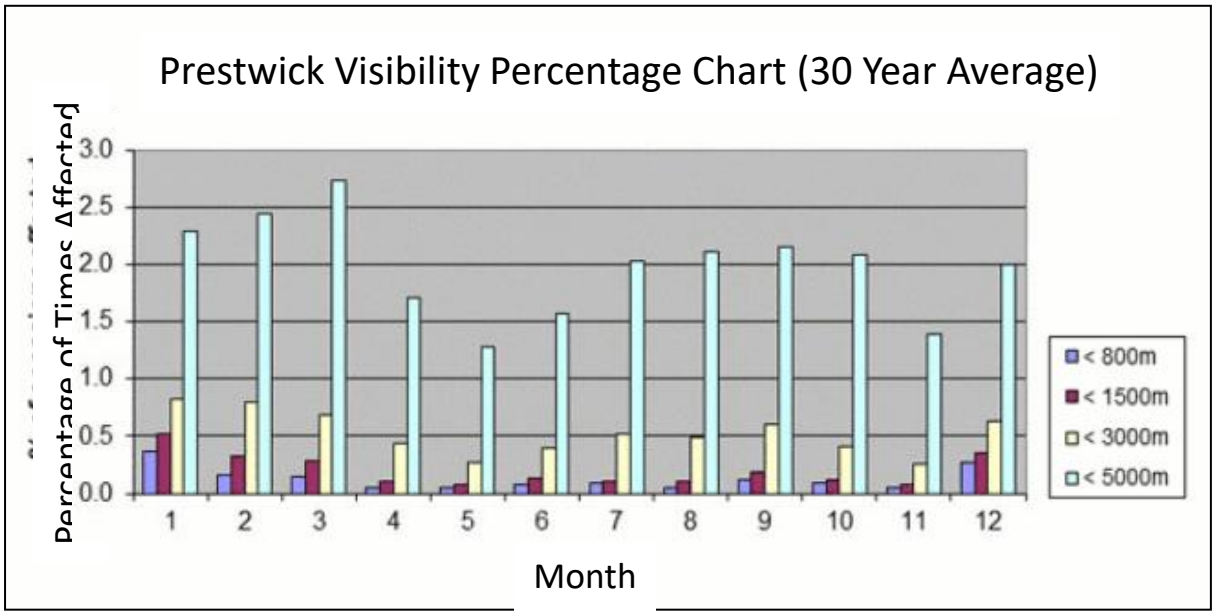
24. The primary mitigation consideration in addition to the already described reduction in brilliance due to elevation angle, is taken from Reference D which states:

    'If the horizontal meteorological visibility in all directions from every wind turbine generator in a group is more than 5 km, the intensity for the light positioned as close as practicable to the top of the fixed structure required to be fitted to any generator in the windfarm and displayed may be reduced to not less than 10% of the minimum peak intensity specified for a light of this type'.

25. It is therefore possible to take advantage of the CAA SARG Policy Statement dated 01/06/2017 and incorporate the option to reduce the hub height lighting to not less than 10% of the minimum peak intensity specified for the installation in good weather. In essence, reducing the 2000cd obstruction lights to 200cd in meteorological visibilities greater than 5km. It should be noted that this does not apply to any low intensity 32cd lights installed halfway up the turbine towers.

Intensity Reduction (ANO Lighting: 2000cd down to 200cd)

26. Accordingly, if it is possible to assess how much time the met visibility will be below 5km, it is also possible to assess how much time the lights would spend at 200cd as opposed to 2000cd. To assess historical visibility on this west coast area, the closest west coast meteorological station is at Prestwick Airport and the closest west coast island meteorological station is at Tiree Airport. The visibility will not be identical to Clachaig Glen at these locations but similar. Unfortunately this information is not available over the period from Campbeltown Airport.



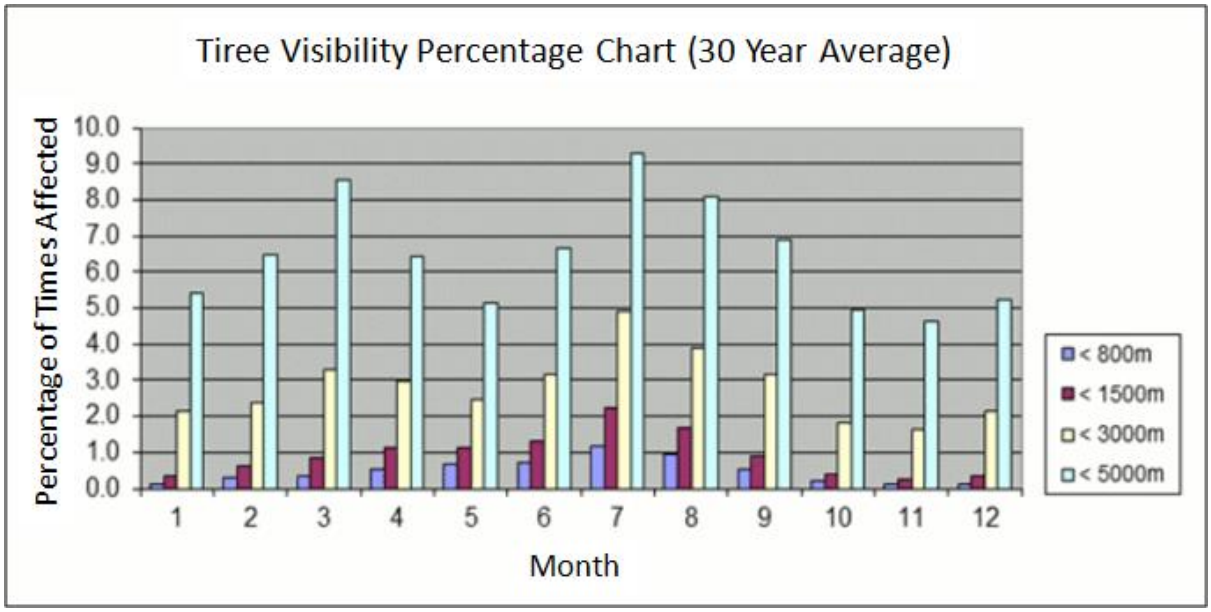


Figure 13 Met Office Historic Visibility Records for Prestwick and Tiree

Analysis of the tables in Figure 13

27. The Prestwick Met Office tables show us that the visibility is historically below 5km (light blue) for an average of 2% of the time. This suggests that the lights will be at:

    - **2000cd for 2% of the time and 200cd for 98% of the time**.

28. The Tiree Met Office table shows us that the visibility is historically below 5km (light blue) for an average of 6% of the time. This suggests that the lights will be at:

    - **2000cd for 6% of the time and 200cd for 94% of the time**.

29. The average of these two stations predicts that for only 4% of the time the ANO lights at Clachaig Glen will be at:

    - **2000cd for 4% of the time and 200cd for 96% of the time.**

30. Whilst Prestwick and Tiree are not Clachaig Glen, these are the closest observation stations available with reliable historic data. When comparing these two met stations (airports) with the higher elevation of Clachaig Glen we can state that meteorological visibility improves with height since the concentration of particles (dust, haze) and liquid droplets (water) reduces with height and the air also becomes thinner. It could be argued that the Clachaig Glen visibility would be better than that at Prestwick or Tiree and the lights would be at 200cd for longer than the 96% of time suggested.

Weather (Cloud) Obscuration of Turbine Lighting.

31. Using the historical data from the same two met stations, it is possible to undertake a similar assessment of historical cloud-base in the area of Clachaig Glen. On occasion, the visibility in the area of Clachaig Glen will drop significantly due to the presence of cloud on the hills. If the turbines are in cloud, then the obstruction lights will not be seen. Similarly, if the turbines are partially shrouded in cloud then the light intensity will be much reduced.

32. Comparing the turbine base heights and hub heights with the historic cloud base events indicates that the turbine lights will indeed be obscured by the cloud bases experienced at Clachaig Glen. Moreover, the following can be added:

    - Historical data indicates that the turbine lights will be obscured on many occasions and most probably on hundreds of occasions per month

    - Red light, as emitted by the ANO lights, is particularly susceptible to absorption by water molecules in the atmosphere, more so than other colours

    - Cloud bases tend to lower in the presence of hills. Accordingly, the cloud bases at Clachaig Glen may be lower than the data from Tiree and Prestwick suggests. The turbine lights will be obscured more often.

33. Clearly, it can be safely assumed that the cloud base over the Clachaig Glen will fully or partially obscure the lighting on the Clachaig Glen Turbines on many occasions per month.

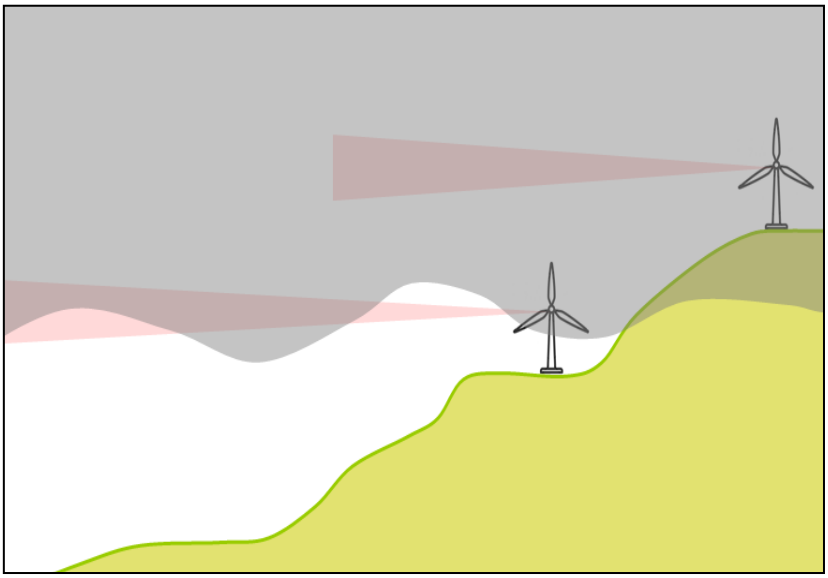


Figure 14 Turbine Visible Light Obscuration by Cloud – Full and Partial

Conclusion/Notes

34. The Clachaig Glen site benefits from the dispensations available in the latest CAA CAP 764 and MOD Obstruction Lighting Guidance to reduce the number of obstruction lights required at the turbine site.

Accordingly, the 12 turbine site requires 8 visible-red and 8 infra-red hub mounted obstruction lights.

- Conversely, the site is in an area where it will benefit from weather obscuration of its visible ANO lighting. This obscuration benefit is potentially quite significant.

- The site also benefits from a high met visibility factor which will allow the visible ANO lights to be reduced to 10% of their rated intensity for the majority of the time.

The lights will be regularly obscured by cloud and when not obscured set at 200cd for 94% of the time.

- The lighting proposals contained within this brief are fully compliant with extant CAA and MOD guidance and advice.

Technical Mitigation

35. One other form of potential mitigation commonly discussed is the installation of an Aircraft Detection Lighting System (ADLS). There are two possible methods of detecting an aircraft approaching a wind farm that will automatically turn on the aviation obstruction lights, firstly through the use of a suitable primary surveillance radar (PSR) or secondly, the use of aircraft installed Electronic Conspicuity (EC) equipment. There are some significant technical and regulatory issues to be overcome before any such system can be installed and operated in the UK.

36. In the case of PSR, this is already in use at wind farms in Europe; as an example the Terma Scanter 5002 radar is installed at a number of sites as shown in Figure 15. The main regulatory constraint is that although such systems are in use in Europe, in the UK, where airspace tends to be shared between users, the CAA have yet to mandate the performance parameters that such a system must be capable of fulfilling. For example, the coverage requirement will need to be defined in terms of maximum range of detection and activation (which may vary depending upon the speed of the aircraft), base of cover (above ground level) and almost certainly a maximum height coverage to avoid unnecessary activations, which a PSR on its own cannot ascertain. An initial set of draft requirements was promulgated in 2018 but these were for discussion with aviation stakeholders and it cannot be assumed that these are going to be the final criteria. Even if the standards are defined, it may be that any single radar will not be capable of delivering the required coverage where a wind farm is located on a hill and aircraft may approach below the wind farm from any direction. It may then become necessary to install multiple radars in order to achieve the required coverage at low level. This in itself may lead to limitations due to mutual interference in what is already a crowded part of the electro-magnetic spectrum, (although the Terma radar does have some anti-interference capabilities) but the additional radars may affect other systems working in the same frequency band. There would also be additional planning issues to consider, such as the

visual impact of additional aerials, and rotating arrays. Technical constraints also mean that it will be necessary to position to radars some distance outside the windfarm as shown in the example below in order to avoid turbines screening the radar and to provide the required height coverage.

Figure 15 Terma 5002 Radar at a Wind Farm in Germany

37. The one major advantage of PSR is that it will detect any aircraft, both those transponding and those that are not, known as non-co-operative targets. Depending upon how the regulatory process moves forwards, this may have a major effect on which systems to use for ADLS. In response to a recent planning inquiry paper the CAA responded stating in a letter dated 21 April 2021: *For the UK, there are some challenges to be resolved. The cost/benefit of the use of primary surveillance radar for the active detection of aircraft, spectrum availability, incentive pricing cost and geographical separation required before frequencies can be re-used potentially makes this a less than optimal solution.*

38. The alternate system is one based upon a reliance on aircraft carried Electronic Conspicuity (EC) transponders. Currently light aircraft flying clear of regulated airspace in the UK below 10,000ft are not required to carry a transponder (one example being Secondary Surveillance Radar or SSR). Most aircraft do, but not all. The CAA has been encouraging fitment by all aircraft and hope to have a regulatory system in place within the next few years requiring all flying machines to be fitted. Unfortunately this is not as simple a process as one might imagine. This issue has been running for at least 20 years so far, however some progress is now being made. In the same response to a recent planning inquiry paper the CAA responded stating: *At the same time, the lack of interoperability between the wide variety of electronic conspicuity devices currently available may require careful consideration of the specification of any passive system receivers and how they are deemed compliant to be deployed and operated.* The letter goes on to state: *We concur that not every situation may require ADLS to be fitted and operated; Article 222 or 223 requirements of the Air Navigation Order will remain, and the CAA may agree a specific solution under Section 7 of Article 222 and Section 11 of Article 223. However, ADLS could potentially provide an acceptable means of compliance that could provide greater certainty for developers when developing planning proposals on CAA acceptance and assist with discussions with communities during planning consultation.* What this letter is saying is that ADSL using EC is technically feasible but that until the regulatory actions concerning the mandatory carriage of a compatible EC system have been completed and signed into law, and the coverage requirements agreed, nothing can be done unless a planning condition to require the retrospective installation of a system is considered appropriate. The length of time that this is likely to take is difficult to

estimate, however, realistically it is likely to be within a two to five year timeframe as it is a small part of a much wider airspace modernisation programme currently under way.

39. What is clear is that once the carriage of compatible transponders is mandated and all aircraft fitted with them, this is likely to be a realistic way of triggering an ADLS system. Such systems are passive at the wind farm and will not, therefore cause any interference. As shown in Figure 16 they require unobtrusive small aerials, approximately 1.2 metres long that are very reliable and relatively inexpensive to install and operate.

Figure 16 ADSB/SSR Passive Aerial

40. Bearing the above in mind, it would be prudent to ensure that any lighting installed on the turbines is compatible with any future EC triggered ADSL system, so that when the regulatory process and aircraft equipage has been completed, it will be a relatively cheap and simple exercise to retro-fit such a system. Alternately, the ADSB/SSR aerials and system could be installed when the wind farm is constructed, ready for activation when required. It may therefore be suitable for use as the basis of a planning condition requiring the activation of the system once the regulatory and fitment hurdles have been overcome.

41. An ADSL system may not be suitable for every location, depending upon the nature of aviation operations at night in the area around the wind farm and the activation criteria that are finally mandated by the CAA. If located close to the approach for a major airport for example, the lights might be required to be turning on and off continuously, however, in a location like Clachaig Glen, with very little, if any night low level civilian traffic, the number of times the lights will activate is likely to be so small as to be statistically insignificant. The ADLS system will be able to differentiate between civil traffic and SAR/HEMS/military traffic using NVD and not therefore activate when these types of aviation operations are taking place within the activation zone for the system. The infra-red lights that these types of operations rely on will always be on at night, but of course are invisible to the naked eye and will have no effect on the visual impact of the development.

Conclusion

42. This report has assessed the requirements for both visible, CAA approved aviation lighting and MOD approved Infra-Red lighting for the Clachaig Glen Wind Farm. The resulting layout is set out

Hazards, 38 Hadrian Way, Chilworth, Southampton SO16 7HX

in Figure 6 and makes use of both CAA/ANO Red lights and MOD IR lights. The proposed layouts will be sent to the CAA and MOD DIO for approval.

43. The report also reports the brilliance of lights that will be visible taking into account the elevation angle between the turbine obstruction light and the viewpoints and the distance between each turbine and each viewpoint. The report shows that for up to 94% of the time, the lights will only be required to operate at 10% luminous intensity which will significantly reduce obstruction light effects in the area. Further interpretation of these results can be undertaken by a Landscape and Visual Impact Assessment expert.

44. The report then identifies additional mitigation options that should the regulatory process allow, would enable the visible medium intensity turbine lights to be switched off for the vast majority of the time and activated only on those rare occasions in this location when an aircraft activates the system. A suitably worded planning condition will enable the future lighting effects to be mitigated to the extent of becoming almost non-existent.

Authors

Cdr John Taylor RN (Ret) – after a career in the Royal Navy specialising in Air Traffic Control (ATC), Airspace Management and Air Defence which culminated in leading both the ATC and Fighter Control Specialisations, John worked for Lockheed Martin UK for three years as a Principal Consultant and Business Area Manager responsible for Air Traffic Management Consultancy, including the provision of advice to wind farm developers. In 2008 he founded WPAC Ltd and since then he and his team have provided aviation advice in relation to over 2000 wind farm and wind turbine sites, given evidence at a number of planning inquiries and enabled many sites to overcome aviation objections where it was feasible to do so. He and his team have also provided advice to a number of Local Planning Authorities, Renewable UK and the Aviation Fund Management Board, including organising workshops and the provision of guidance documents. John also advises planners and developers in relation to physical and technical safeguarding of non-wind farm developments in the vicinity of aviation facilities.

Sqn Ldr Mike Hale RAF (Rtd) has over 45 years, piloting, instructing and examining experience on numerous military fast jet aircraft through to a range of civilian and military general aviation training aircraft and gliders. He has held many posts including Flying Instructor, Training Officer, Flight Commander, Squadron Commander and Principal Tornado AD Force Examiner. He has amassed over 10,000 flying hours of experience when operating at many locations around the world. In parallel to his flying duties, Mike held the post of Officer Commanding the MOD Low Flying Operations Squadron (OC LFOS). In this post he was both Low Level Airspace Manager for the MOD & Wind-Farm Subject Matter Expert for the Defence Infrastructure Organization (DIO). During that period, he assessed over 14,000 wind-farm pre-applications and 2000 full applications against low flying, weapons range, specialist airspace, local community and aerodrome safeguarding criteria. Mike also instigated two Qinetiq ground based Infra Red obstruction lighting trials. These were followed by instigating and managing the MOD Infra Red/Low Intensity (Henlow) flight trials and the CAA/MOD/Trinity-House/RUK off-shore IR/Morse (North Hoyle) flight trials. In conjunction, Mike organised numerous and various supporting trials including night vision equipment compatibility and detailed lighting beam overspill analysis (where light is emitted outside the required specification envelope). In 2012, he was awarded an MBE for generating a proactive and mutually successful working relationship between the Wind Power Industry and the MOD Air Staff.

Cdr John Taylor RN (Ret)
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Appendix A – Abbreviations and Definitions

ADSB……..……Automatic Dependent Surveillance Broadcast
AGL.....Above Ground Level (Height)
ANO.....Air Navigation Order
AMSL.....Above Mean Sea Level (Elevation)
ASG.....Aviation Steering Group
CAA.....Civil Aviation Authority
CAP.....Civil Aviation Publication (Referrers to Specific Documents)
cd.....Candela, a measure of light intensity
DIO.....Defence Infrastructure Organisation
HNTA.....Helicopter Night Training Area
In Flight Visibility.....The distance a pilot can see ahead to fly & navigate the aircraft
IR.....Infra-Red
Kts.....Knots: a measure of airspeed (10 kts = 12mph = 19 kph)
LED.....Light Emitting Diode
MOD.....Ministry of Defence
mW/sr.....milliWatts per steradian: electromagnetic energy output related to solid angle
Nm.....Nautical Mile
NVD .....Night Vision Devices - Aircraft Mounted
NVG.....Night Vision Goggles - Operator Worn
Radar Altimeter.....An altimeter that uses radar to accurately measure height above ground
QFE .....Setting on Altimeter that gives Height above Airfield
RoAR.....Rules of the Air Regulations
Rule 5.....The Low Flying Rule – part of RoAR
Rule 28.....VFR Rules Outside Controlled Airspace – part of the RoAR
ReUK.....Renewables UK – The UK Wind Industry Body
SAR Box.....Night Training Area for Search and Rescue Helicopter Units
SSA.....Sector Safety Altitude
SSR…….Secondary Surveillance Radar
UKAB.....United Kingdom Air Prox Board – Investigates Aircraft Near Misses
VFR.....Visual Flight Rules (Flight without ATC on a see-and-be-seen basis)
VMC.....Visual Meteorological Conditions (Weather suitable for VFR flight)

Hazards, 38 Hadrian Way, Chilworth, Southampton SO16 7HX

RWE

Clachaig Glen Wind Farm

Environmental Impact Assessment Report

Volume 3

Technical Appendices

Appendix 18.1: Shadow Flicker Detailed Results

Project:
Clachaig_Glen_210805

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Calculated:
05/08/2021 17:52/3.0.651

SHADOW - Main Result

Calculation: SF ES Layout 210805

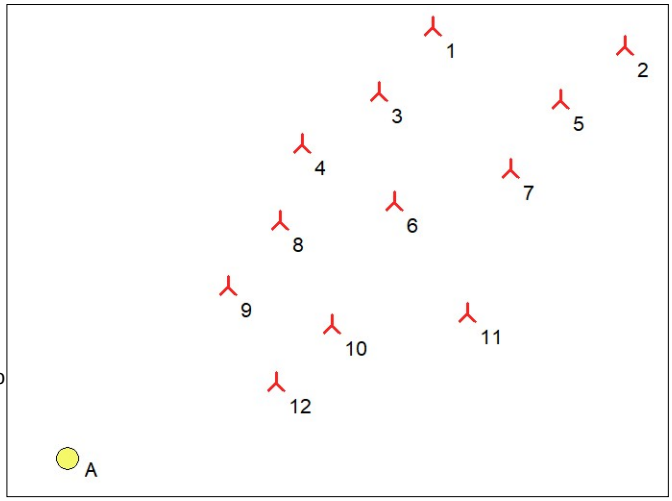
Assumptions for shadow calculations

Maximum distance for influence	1,600	m
Minimum sun height over horizon for influence	3	°
Day step for calculation	1	days
Time step for calculation	1	minutes

The calculated times are "worst case" given by the following assumptions:
The sun is shining all the day, from sunrise to sunset
The rotor plane is always perpendicular to the line from the WTG to the sun
The WTG is always operating

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window. The ZVI calculation is based on the following assumptions:
Height contours used: Height Contours: CONTOURLINE_ONLINEDATA_0.wpo
Obstacles used in calculation
Eye height: 1.5 m
Grid resolution: 10.0 m

All coordinates are in
British TM-OSGB36/Airy (GB/IE)



Scale 1:40,000
New WTG
Shadow receptor

WTGs

	Easting	Northing	Z [m]	Row data/Description	WTG type Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	RPM [RPM]
1	172,042	643,025	245.2	Siemens Gamesa SG 6.0-155 6600 155.0...	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	107.5	9.3
2	173,055	642,867	275.4	Siemens Gamesa SG 6.0-155 6600 155.0...	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	107.5	9.3
3	171,741	642,693	240.1	Siemens Gamesa SG 6.0-155 6600 155.0...	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	107.5	9.3
4	171,316	642,438	202.0	Siemens Gamesa SG 6.0-155 6600 155.0...	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	107.5	9.3
5	172,701	642,602	265.5	Siemens Gamesa SG 6.0-155 6600 155.0...	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	107.5	9.3
6	171,789	642,110	232.6	Siemens Gamesa SG 6.0-155 6600 155.0...	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	107.5	9.3
7	172,417	642,250	232.3	Siemens Gamesa SG 6.0-155 6600 155.0...	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	122.5	9.3
8	171,178	642,039	184.9	Siemens Gamesa SG 6.0-155 6600 155.0...	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	107.5	9.3
9	170,883	641,708	157.2	Siemens Gamesa SG 6.0-155 6600 155.0...	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	122.5	9.3
10	171,426	641,475	172.1	Siemens Gamesa SG 6.0-155 6600 155.0...	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	122.5	9.3
11	172,149	641,498	191.2	Siemens Gamesa SG 6.0-155 6600 155.0...	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	122.5	9.3
12	171,113	641,187	175.3	Siemens Gamesa SG 6.0-155 6600 155.0...	Yes	Siemens Gamesa	SG 6.0-155-6,600	6,600	155.0	122.5	9.3

Shadow receptor-Input

No.	Easting	Northing	Z [m]	Width [m]	Height [m]	Height a.g.l. [m]	Degrees from south cw [°]	Slope of window [°]	Direction mode
A	169,985	640,844	131.5	1.0	1.0	1.0	-180.0	90.0	"Green house mode"

Calculation Results

Shadow receptor

Shadow, worst case

No.	Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]
A	42:32	76	0:54

Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Expected [h/year]
1	Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 107.5 m (TOT: 185.0 m) (52)	0:00	
2	Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 107.5 m (TOT: 185.0 m) (53)	0:00	
3	Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 107.5 m (TOT: 185.0 m) (54)	0:00	
4	Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 107.5 m (TOT: 185.0 m) (55)	0:00	
5	Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 107.5 m (TOT: 185.0 m) (56)	0:00	
6	Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 107.5 m (TOT: 185.0 m) (57)	0:00	
7	Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 122.5 m (TOT: 200.0 m) (58)	0:00	

To be continued on next page...

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SHADOW - Main Result

Calculation: SF ES Layout 210805

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
8	Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 107.5 m (TOT: 185.0 m) (59)	0:00	
9	Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 122.5 m (TOT: 200.0 m) (60)	0:00	
10	Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 122.5 m (TOT: 200.0 m) (61)	17:27	
11	Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 122.5 m (TOT: 200.0 m) (62)	0:00	
12	Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 122.5 m (TOT: 200.0 m) (63)	25:05	

Project:

Clachaig_Glen_210805

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Calculated:
05/08/2021 17:52/3.0.651

SHADOW - Calendar

Calculation: SF ES Layout 210805Shadow receptor: A - Shadow Receptor: 1.0 × 1.0 Azimuth: -180.0° Slope: 90.0° (16)

Assumptions for shadow calculations

Reference year for calendar 2021

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	January	February	March	April			May			June		
1	08:50	08:16	07:15	06:55			05:41		06:20 (12)	04:47		05:56 (10)
	15:59	16:53	17:53	19:57			20:57	21	06:41 (12)	21:51	13	06:09 (10)
2	08:50	08:14	07:12	06:52			05:39		06:18 (12)	04:46		05:57 (10)
	16:00	16:55	17:55	19:59			20:59	24	06:42 (12)	21:53	11	06:08 (10)
3	08:49	08:12	07:10	06:50			05:37		06:17 (12)	04:45		05:58 (10)
	16:01	16:58	17:58	20:01			21:00	26	06:43 (12)	21:54	9	06:07 (10)
4	08:49	08:11	07:07	06:47			05:34		06:16 (12)	04:44		06:00 (10)
	16:02	17:00	18:00	20:03			21:02	28	06:44 (12)	21:55	6	06:06 (10)
5	08:49	08:09	07:05	06:45			05:32		06:16 (12)	04:43		
	16:04	17:02	18:02	20:05			21:04	28	06:44 (12)	21:56		
6	08:48	08:07	07:02	06:42			05:30		06:15 (12)	04:42		
	16:05	17:04	18:04	20:07			21:06	29	06:44 (12)	21:57		
7	08:48	08:05	07:00	06:40			05:28		06:14 (12)	04:41		
	16:06	17:06	18:06	20:09			21:08	31	06:45 (12)	21:59		
8	08:47	08:03	06:57	06:37			05:26		05:57 (10)	04:41		
	16:08	17:08	18:08	20:11			21:10	39	06:45 (12)	22:00		
9	08:46	08:01	06:55	06:34			05:24		05:55 (10)	04:40		
	16:09	17:11	18:10	20:13			21:12	44	06:46 (12)	22:01		
10	08:46	07:58	06:52	06:32			05:22		05:54 (10)	04:39		
	16:11	17:13	18:12	20:15			21:14	47	06:46 (12)	22:02		
11	08:45	07:56	06:49	06:29			05:20		05:52 (10)	04:39		
	16:13	17:15	18:14	20:17			21:16	50	06:46 (12)	22:02		
12	08:44	07:54	06:47	06:27			05:18		05:51 (10)	04:38		
	16:14	17:17	18:16	20:19			21:18	51	06:45 (12)	22:03		
13	08:43	07:52	06:44	06:24			05:16		05:50 (10)	04:38		
	16:16	17:19	18:18	20:21			21:20	52	06:45 (12)	22:04		
14	08:42	07:50	06:42	06:22			05:14		05:50 (10)	04:37		
	16:18	17:21	18:20	20:23			21:22	53	06:45 (12)	22:05		
15	08:41	07:48	06:39	06:19			05:12		05:50 (10)	04:37		
	16:19	17:24	18:22	20:25			21:24	54	06:45 (12)	22:05		
16	08:40	07:45	06:37	06:17			05:10		05:49 (10)	04:37		
	16:21	17:26	18:24	20:27			21:25	53	06:44 (12)	22:06		
17	08:39	07:43	06:34	06:14			05:09		05:49 (10)	04:37		
	16:23	17:28	18:26	20:29			21:27	53	06:44 (12)	22:07		
18	08:38	07:41	06:31	06:12			05:07		05:49 (10)	04:37		
	16:25	17:30	18:28	20:31			21:29	52	06:43 (12)	22:07		
19	08:37	07:39	06:29	06:09			05:05		05:49 (10)	04:37		
	16:27	17:32	18:30	20:33			21:31	52	06:43 (12)	22:08		
20	08:35	07:36	06:26	06:07			05:03		05:49 (10)	04:37		
	16:29	17:34	18:32	20:35			21:32	49	06:42 (12)	22:08		
21	08:34	07:34	06:24	06:04			05:02		05:50 (10)	04:37		
	16:31	17:36	18:34	20:37			21:34	47	06:42 (12)	22:08		
22	08:32	07:32	06:21	06:02			05:00		05:49 (10)	04:37		
	16:33	17:39	18:36	20:39			21:36	47	06:41 (12)	22:08		
23	08:31	07:29	06:18	06:00			04:59		05:50 (10)	04:37		
	16:35	17:41	18:38	20:41			21:38	44	06:40 (12)	22:09		
24	08:30	07:27	06:16	05:57			04:57		05:51 (10)	04:38		
	16:37	17:43	18:41	20:43			21:39	42	06:40 (12)	22:09		
25	08:28	07:24	06:13	05:55			04:56		05:51 (10)	04:38		
	16:39	17:45	18:43	20:45			21:41	39	06:39 (12)	22:09		
26	08:26	07:22	06:11	05:53			04:54		05:51 (10)	04:38		
	16:41	17:47	18:45	20:47			21:42	36	06:37 (12)	22:09		
27	08:25	07:19	06:08	05:50			04:53		05:52 (10)	04:39		
	16:43	17:49	18:47	20:49			21:44	31	06:35 (12)	22:08		
28	08:23	07:17	07:05	05:48		06:28 (12)	04:52		05:52 (10)	04:39		
	16:45	17:51	19:49	20:51	6	06:34 (12)	21:46	25	06:33 (12)	22:08		
29	08:22		07:03	05:46		06:24 (12)	04:50		05:53 (10)	04:40		
	16:47		19:51	20:53	14	06:38 (12)	21:47	18	06:11 (10)	22:08		
30	08:20		07:00	05:43		06:22 (12)	04:49		05:54 (10)	04:41		
	16:49		19:53	20:55	18	06:40 (12)	21:48	16	06:10 (10)	22:08		
31	08:18		06:58				04:48		05:55 (10)			
	16:51		19:55				21:50	15	06:10 (10)			
Potential sun hours	240	268	366	424			503			522		
Total, worst case					38			1196			39	

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:

Clachaig_Glen_210805

Licensed user:
AECOM Professional Services LLP Limited
First Floor, One Trinity Gardens, Quayside
GB-NEWCASTLE upon Tyne NE1 2HF
+44 191 224 6610
Laura Craggs / laura.craggs@aecom.com

Calculated:
05/08/2021 17:52/3.0.651

SHADOW - Calendar

Calculation: SF ES Layout 210805Shadow receptor: A - Shadow Receptor: 1.0 × 1.0 Azimuth: -180.0° Slope: 90.0° (16)

Assumptions for shadow calculations

Reference year for calendar 2021

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	July			August			September	October	November	December
1	04:41			05:25		06:01 (10)	06:24	07:21	07:24	08:24
	22:07			21:29	51	06:55 (12)	20:17	18:59	16:44	15:55
2	04:42			05:26		06:02 (10)	06:26	07:23	07:26	08:25
	22:07			21:27	51	06:56 (12)	20:15	18:57	16:42	15:54
3	04:43			05:28		06:04 (10)	06:28	07:25	07:28	08:27
	22:06			21:25	48	06:56 (12)	20:12	18:54	16:40	15:53
4	04:44			05:30		06:04 (10)	06:29	07:27	07:30	08:28
	22:06			21:23	45	06:55 (12)	20:10	18:52	16:38	15:53
5	04:45			05:32		06:07 (10)	06:31	07:29	07:33	08:30
	22:05			21:21	40	06:55 (12)	20:07	18:49	16:36	15:52
6	04:46			05:34		06:25 (12)	06:33	07:31	07:35	08:31
	22:05			21:19	30	06:55 (12)	20:05	18:46	16:34	15:51
7	04:47			05:36		06:25 (12)	06:35	07:33	07:37	08:33
	22:04			21:17	30	06:55 (12)	20:02	18:44	16:32	15:51
8	04:48			05:38		06:25 (12)	06:37	07:35	07:39	08:34
	22:03			21:14	29	06:54 (12)	19:59	18:41	16:30	15:50
9	04:49		06:07 (10)	05:40		06:26 (12)	06:39	07:37	07:41	08:36
	22:02	6	06:13 (10)	21:12	27	06:53 (12)	19:57	18:39	16:28	15:50
10	04:50		06:06 (10)	05:41		06:26 (12)	06:41	07:39	07:43	08:37
	22:01	9	06:15 (10)	21:10	26	06:52 (12)	19:54	18:36	16:26	15:49
11	04:51		06:05 (10)	05:43		06:27 (12)	06:43	07:41	07:45	08:38
	22:00	11	06:16 (10)	21:08	25	06:52 (12)	19:52	18:34	16:24	15:49
12	04:53		06:04 (10)	05:45		06:28 (12)	06:45	07:43	07:47	08:39
	21:59	13	06:17 (10)	21:06	21	06:49 (12)	19:49	18:31	16:22	15:49
13	04:54		06:03 (10)	05:47		06:29 (12)	06:47	07:45	07:49	08:40
	21:58	15	06:18 (10)	21:03	19	06:48 (12)	19:46	18:29	16:20	15:49
14	04:55		06:02 (10)	05:49		06:31 (12)	06:49	07:47	07:51	08:41
	21:57	16	06:18 (10)	21:01	15	06:46 (12)	19:44	18:26	16:18	15:48
15	04:57		06:02 (10)	05:51		06:34 (12)	06:51	07:49	07:53	08:43
	21:56	18	06:20 (10)	20:59	9	06:43 (12)	19:41	18:24	16:17	15:48
16	04:58		06:01 (10)	05:53			06:52	07:51	07:55	08:43
	21:55	25	06:42 (12)	20:57			19:39	18:21	16:15	15:48
17	05:00		06:01 (10)	05:55			06:54	07:53	07:57	08:44
	21:53	31	06:44 (12)	20:54			19:36	18:19	16:13	15:49
18	05:01		06:01 (10)	05:57			06:56	07:55	07:59	08:45
	21:52	36	06:47 (12)	20:52			19:33	18:16	16:12	15:49
19	05:03		06:00 (10)	05:59			06:58	07:57	08:01	08:46
	21:51	39	06:48 (12)	20:49			19:31	18:14	16:10	15:49
20	05:04		06:01 (10)	06:01			07:00	07:59	08:03	08:47
	21:49	42	06:50 (12)	20:47			19:28	18:12	16:09	15:49
21	05:06		06:00 (10)	06:03			07:02	08:01	08:05	08:47
	21:48	44	06:50 (12)	20:45			19:25	18:09	16:07	15:50
22	05:07		05:59 (10)	06:04			07:04	08:03	08:07	08:48
	21:46	47	06:51 (12)	20:42			19:23	18:07	16:06	15:50
23	05:09		06:00 (10)	06:06			07:06	08:05	08:09	08:48
	21:45	47	06:52 (12)	20:40			19:20	18:04	16:04	15:51
24	05:11		06:00 (10)	06:08			07:08	08:08	08:11	08:49
	21:43	49	06:53 (12)	20:37			19:18	18:02	16:03	15:51
25	05:12		06:00 (10)	06:10			07:10	08:10	08:13	08:49
	21:41	50	06:53 (12)	20:35			19:15	18:00	16:02	15:52
26	05:14		06:00 (10)	06:12			07:12	08:12	08:15	08:49
	21:40	52	06:54 (12)	20:32			19:12	17:57	16:01	15:53
27	05:16		06:00 (10)	06:14			07:14	08:14	08:17	08:50
	21:38	52	06:54 (12)	20:30			19:10	17:55	15:59	15:53
28	05:18		06:00 (10)	06:16			07:16	08:16	08:18	08:50
	21:36	54	06:55 (12)	20:28			19:07	17:53	15:58	15:54
29	05:19		06:00 (10)	06:18			07:17	08:18	08:20	08:50
	21:34	53	06:55 (12)	20:25			19:05	17:51	15:57	15:55
30	05:21		06:01 (10)	06:20			07:19	08:20	08:22	08:50
	21:32	52	06:55 (12)	20:23			19:02	17:48	15:56	15:56
31	05:23		06:01 (10)	06:22				07:22		08:50
	21:31	52	06:56 (12)	20:20				16:46		15:57
Potential sun hours	523			466			384	326	252	222
Total, worst case		813			466					

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)		First time (hh:mm) with flicker	(WTG causing flicker first time)
	Sun set (hh:mm)	Minutes with flicker	Last time (hh:mm) with flicker	(WTG causing flicker last time)

Project:
Clachaig_Glen_210805

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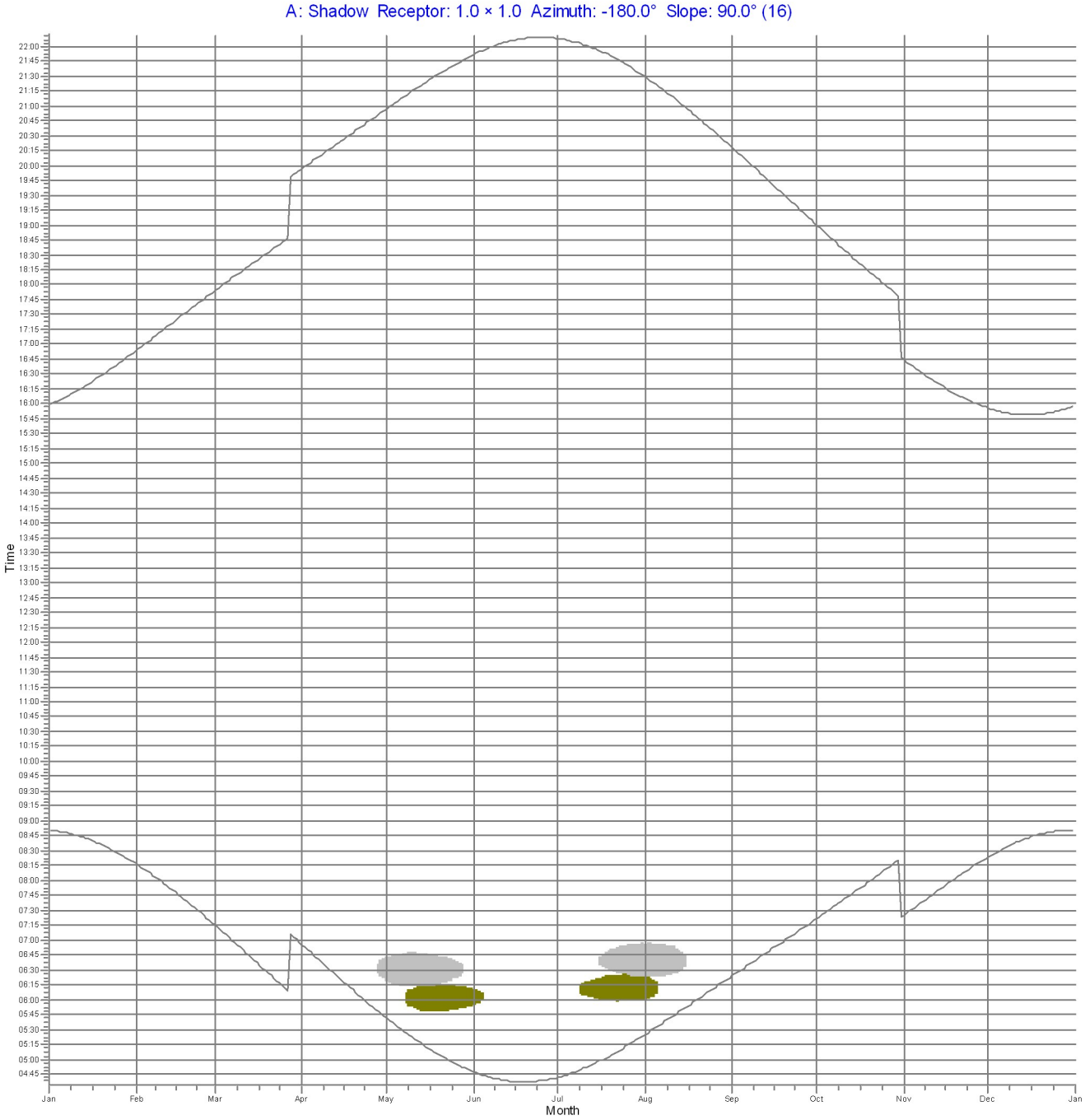
+44 191 224 6610
Laura Craggs / laura.craggs@aecom.com
Calculated:
05/08/2021 17:52/3.0.651

SHADOW - Calendar, graphical

Calculation: SF ES Layout 210805Shadow receptor: A - Shadow Receptor: 1.0 × 1.0 Azimuth: -180.0° Slope: 90.0° (16)



WTGs

10: Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 122.5 m (TOT: 200.0 m) (61)

12: Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 122.5 m (TOT: 200.0 m) (63)

Project:

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Laura Craggs / laura.craggs@aecom.com

Calculated:
05/08/2021 17:52/3.0.651

SHADOW - Calendar per WTG

Calculation: SF ES Layout 210805WTG: 1 - Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 107.5 m (TOT: 185.0 m) (52)

Assumptions for shadow calculations

Reference year for calendar 2021

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:50	08:16	07:15	06:55	05:41	04:47	04:41	05:24	06:24	07:21	07:24	08:24
	15:58	16:53	17:53	19:56	20:56	21:51	22:07	21:29	20:17	18:59	16:44	15:55
2	08:50	08:14	07:12	06:52	05:39	04:45	04:42	05:26	06:25	07:23	07:26	08:25
	15:59	16:55	17:55	19:58	20:58	21:53	22:07	21:27	20:15	18:57	16:42	15:54
3	08:49	08:12	07:10	06:50	05:36	04:44	04:43	05:28	06:27	07:25	07:28	08:27
	16:01	16:57	17:57	20:00	21:00	21:54	22:07	21:25	20:12	18:54	16:40	15:53
4	08:49	08:11	07:07	06:47	05:34	04:43	04:44	05:30	06:29	07:27	07:30	08:28
	16:02	17:00	18:00	20:02	21:02	21:55	22:06	21:23	20:10	18:51	16:37	15:52
5	08:49	08:09	07:05	06:44	05:32	04:43	04:44	05:32	06:31	07:29	07:33	08:30
	16:03	17:02	18:02	20:04	21:04	21:56	22:05	21:21	20:07	18:49	16:35	15:52
6	08:48	08:07	07:02	06:42	05:30	04:42	04:45	05:34	06:33	07:31	07:35	08:31
	16:05	17:04	18:04	20:06	21:06	21:57	22:05	21:19	20:05	18:46	16:33	15:51
7	08:48	08:05	07:00	06:39	05:28	04:41	04:46	05:36	06:35	07:33	07:37	08:33
	16:06	17:06	18:06	20:08	21:08	21:59	22:04	21:16	20:02	18:44	16:31	15:50
8	08:47	08:03	06:57	06:37	05:26	04:40	04:48	05:37	06:37	07:35	07:39	08:34
	16:08	17:08	18:08	20:10	21:10	22:00	22:03	21:14	19:59	18:41	16:29	15:50
9	08:46	08:00	06:54	06:34	05:24	04:40	04:49	05:39	06:39	07:37	07:41	08:36
	16:09	17:10	18:10	20:12	21:12	22:01	22:02	21:12	19:57	18:39	16:27	15:49
10	08:46	07:58	06:52	06:32	05:22	04:39	04:50	05:41	06:41	07:39	07:43	08:37
	16:11	17:13	18:12	20:14	21:14	22:02	22:01	21:10	19:54	18:36	16:26	15:49
11	08:45	07:56	06:49	06:29	05:20	04:38	04:51	05:43	06:43	07:41	07:45	08:38
	16:12	17:15	18:14	20:16	21:16	22:03	22:00	21:08	19:52	18:34	16:24	15:49
12	08:44	07:54	06:47	06:27	05:18	04:38	04:52	05:45	06:45	07:43	07:47	08:39
	16:14	17:17	18:16	20:18	21:18	22:03	21:59	21:06	19:49	18:31	16:22	15:49
13	08:43	07:52	06:44	06:24	05:16	04:38	04:54	05:47	06:47	07:45	07:49	08:40
	16:16	17:19	18:18	20:20	21:20	22:04	21:58	21:03	19:46	18:29	16:20	15:48
14	08:42	07:50	06:42	06:22	05:14	04:37	04:55	05:49	06:48	07:47	07:51	08:42
	16:17	17:21	18:20	20:22	21:22	22:05	21:57	21:01	19:44	18:26	16:18	15:48
15	08:41	07:48	06:39	06:19	05:12	04:37	04:56	05:51	06:50	07:49	07:53	08:43
	16:19	17:23	18:22	20:24	21:23	22:06	21:56	20:59	19:41	18:24	16:16	15:48
16	08:40	07:45	06:36	06:17	05:10	04:37	04:58	05:53	06:52	07:51	07:55	08:43
	16:21	17:26	18:24	20:26	21:25	22:06	21:55	20:56	19:38	18:21	16:15	15:48
17	08:39	07:43	06:34	06:14	05:08	04:37	04:59	05:55	06:54	07:53	07:57	08:44
	16:23	17:28	18:26	20:28	21:27	22:07	21:53	20:54	19:36	18:19	16:13	15:48
18	08:38	07:41	06:31	06:12	05:07	04:36	05:01	05:57	06:56	07:55	07:59	08:45
	16:25	17:30	18:28	20:30	21:29	22:07	21:52	20:52	19:33	18:16	16:12	15:48
19	08:36	07:38	06:29	06:09	05:05	04:36	05:02	05:59	06:58	07:57	08:01	08:46
	16:27	17:32	18:30	20:33	21:31	22:08	21:51	20:49	19:31	18:14	16:10	15:49
20	08:35	07:36	06:26	06:07	05:03	04:36	05:04	06:00	07:00	07:59	08:03	08:47
	16:29	17:34	18:32	20:35	21:32	22:08	21:49	20:47	19:28	18:11	16:08	15:49
21	08:34	07:34	06:23	06:04	05:02	04:37	05:06	06:02	07:02	08:01	08:05	08:47
	16:30	17:36	18:34	20:37	21:34	22:08	21:48	20:45	19:25	18:09	16:07	15:49
22	08:32	07:31	06:21	06:02	05:00	04:37	05:07	06:04	07:04	08:03	08:07	08:48
	16:32	17:38	18:36	20:39	21:36	22:08	21:46	20:42	19:23	18:07	16:06	15:50
23	08:31	07:29	06:18	05:59	04:58	04:37	05:09	06:06	07:06	08:05	08:09	08:48
	16:34	17:41	18:38	20:41	21:38	22:09	21:45	20:40	19:20	18:04	16:04	15:50
24	08:30	07:27	06:16	05:57	04:57	04:37	05:10	06:08	07:08	08:07	08:11	08:49
	16:36	17:43	18:40	20:43	21:39	22:09	21:43	20:37	19:17	18:02	16:03	15:51
25	08:28	07:24	06:13	05:55	04:55	04:38	05:12	06:10	07:10	08:10	08:13	08:49
	16:38	17:45	18:42	20:45	21:41	22:09	21:41	20:35	19:15	18:00	16:02	15:52
26	08:26	07:22	06:10	05:52	04:54	04:38	05:14	06:12	07:12	08:12	08:15	08:49
	16:41	17:47	18:44	20:47	21:42	22:09	21:40	20:32	19:12	17:57	16:00	15:52
27	08:25	07:19	06:08	05:50	04:53	04:39	05:16	06:14	07:13	08:14	08:17	08:50
	16:43	17:49	18:46	20:49	21:44	22:09	21:38	20:30	19:10	17:55	15:59	15:53
28	08:23	07:17	07:05	05:48	04:51	04:39	05:17	06:16	07:15	08:16	08:18	08:50
	16:45	17:51	19:48	20:51	21:46	22:08	21:36	20:27	19:07	17:53	15:58	15:54
29	08:21		07:03	05:45	04:50	04:40	05:19	06:18	07:17	08:18	08:20	08:50
	16:47		19:50	20:53	21:47	22:08	21:34	20:25	19:04	17:50	15:57	15:55
30	08:20		07:00	05:43	04:49	04:40	05:21	06:20	07:19	08:20	08:22	08:50
	16:49		19:52	20:54	21:48	22:08	21:32	20:22	19:02	17:48	15:56	15:56
31	08:18		06:57		04:48		05:23	06:22		07:22		08:50
	16:51		19:54		21:50		21:31	20:20		16:46		15:57
Potential sun hours	240	268	366	424	503	522	524	466	384	326	252	222
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Clachaig_Glen_210805

Licensed user:
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GB-NEWCASTLE upon Tyne NE1 2HF
+44 191 224 6610
Laura Craggs / laura.craggs@aecom.com

Calculated:
05/08/2021 17:52/3.0.651

SHADOW - Calendar per WTG

Calculation: SF ES Layout 210805WTG: 2 - Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 107.5 m (TOT: 185.0 m) (53)

Assumptions for shadow calculations

Reference year for calendar 2021

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:50	08:16	07:14	06:55	05:41	04:46	04:41	05:24	06:23	07:21	07:24	08:23
	15:58	16:53	17:53	19:56	20:56	21:51	22:07	21:29	20:17	18:59	16:44	15:55
2	08:50	08:14	07:12	06:52	05:39	04:45	04:42	05:26	06:25	07:23	07:26	08:25
	15:59	16:55	17:55	19:58	20:58	21:53	22:07	21:27	20:15	18:57	16:42	15:54
3	08:49	08:12	07:09	06:50	05:36	04:44	04:43	05:28	06:27	07:25	07:28	08:27
	16:01	16:57	17:57	20:00	21:00	21:54	22:06	21:25	20:12	18:54	16:40	15:53
4	08:49	08:10	07:07	06:47	05:34	04:43	04:43	05:30	06:29	07:27	07:30	08:28
	16:02	16:59	17:59	20:02	21:02	21:55	22:06	21:23	20:10	18:51	16:37	15:52
5	08:49	08:08	07:04	06:44	05:32	04:43	04:44	05:32	06:31	07:29	07:32	08:30
	16:03	17:02	18:02	20:04	21:04	21:56	22:05	21:21	20:07	18:49	16:35	15:52
6	08:48	08:07	07:02	06:42	05:30	04:42	04:45	05:34	06:33	07:31	07:35	08:31
	16:05	17:04	18:04	20:06	21:06	21:57	22:05	21:19	20:04	18:46	16:33	15:51
7	08:48	08:05	06:59	06:39	05:28	04:41	04:46	05:36	06:35	07:33	07:37	08:33
	16:06	17:06	18:06	20:08	21:08	21:59	22:04	21:16	20:02	18:44	16:31	15:50
8	08:47	08:02	06:57	06:37	05:26	04:40	04:48	05:37	06:37	07:35	07:39	08:34
	16:07	17:08	18:08	20:10	21:10	22:00	22:03	21:14	19:59	18:41	16:29	15:50
9	08:46	08:00	06:54	06:34	05:24	04:40	04:49	05:39	06:39	07:37	07:41	08:36
	16:09	17:10	18:10	20:12	21:12	22:01	22:02	21:12	19:57	18:39	16:27	15:49
10	08:46	07:58	06:52	06:32	05:22	04:39	04:50	05:41	06:41	07:39	07:43	08:37
	16:11	17:12	18:12	20:14	21:14	22:02	22:01	21:10	19:54	18:36	16:25	15:49
11	08:45	07:56	06:49	06:29	05:20	04:38	04:51	05:43	06:43	07:41	07:45	08:38
	16:12	17:15	18:14	20:16	21:16	22:02	22:00	21:08	19:52	18:34	16:24	15:49
12	08:44	07:54	06:47	06:27	05:18	04:38	04:52	05:45	06:45	07:43	07:47	08:39
	16:14	17:17	18:16	20:18	21:18	22:03	21:59	21:06	19:49	18:31	16:22	15:48
13	08:43	07:52	06:44	06:24	05:16	04:37	04:54	05:47	06:47	07:45	07:49	08:40
	16:16	17:19	18:18	20:20	21:20	22:04	21:58	21:03	19:46	18:28	16:20	15:48
14	08:42	07:50	06:42	06:22	05:14	04:37	04:55	05:49	06:48	07:47	07:51	08:41
	16:17	17:21	18:20	20:22	21:22	22:05	21:57	21:01	19:44	18:26	16:18	15:48
15	08:41	07:47	06:39	06:19	05:12	04:37	04:56	05:51	06:50	07:49	07:53	08:42
	16:19	17:23	18:22	20:24	21:23	22:05	21:56	20:59	19:41	18:24	16:16	15:48
16	08:40	07:45	06:36	06:17	05:10	04:37	04:58	05:53	06:52	07:51	07:55	08:43
	16:21	17:25	18:24	20:26	21:25	22:06	21:55	20:56	19:38	18:21	16:15	15:48
17	08:39	07:43	06:34	06:14	05:08	04:36	04:59	05:55	06:54	07:53	07:57	08:44
	16:23	17:28	18:26	20:28	21:27	22:07	21:53	20:54	19:36	18:19	16:13	15:48
18	08:38	07:41	06:31	06:12	05:07	04:36	05:01	05:57	06:56	07:55	07:59	08:45
	16:25	17:30	18:28	20:30	21:29	22:07	21:52	20:52	19:33	18:16	16:11	15:48
19	08:36	07:38	06:29	06:09	05:05	04:36	05:02	05:58	06:58	07:57	08:01	08:46
	16:27	17:32	18:30	20:32	21:31	22:07	21:51	20:49	19:31	18:14	16:10	15:49
20	08:35	07:36	06:26	06:07	05:03	04:36	05:04	06:00	07:00	07:59	08:03	08:47
	16:28	17:34	18:32	20:34	21:32	22:08	21:49	20:47	19:28	18:11	16:08	15:49
21	08:34	07:34	06:23	06:04	05:02	04:37	05:05	06:02	07:02	08:01	08:05	08:47
	16:30	17:36	18:34	20:36	21:34	22:08	21:48	20:45	19:25	18:09	16:07	15:49
22	08:32	07:31	06:21	06:02	05:00	04:37	05:07	06:04	07:04	08:03	08:07	08:48
	16:32	17:38	18:36	20:38	21:36	22:08	21:46	20:42	19:23	18:07	16:05	15:50
23	08:31	07:29	06:18	05:59	04:58	04:37	05:09	06:06	07:06	08:05	08:09	08:48
	16:34	17:40	18:38	20:40	21:38	22:08	21:45	20:40	19:20	18:04	16:04	15:50
24	08:29	07:27	06:16	05:57	04:57	04:37	05:10	06:08	07:08	08:07	08:11	08:49
	16:36	17:43	18:40	20:42	21:39	22:09	21:43	20:37	19:17	18:02	16:03	15:51
25	08:28	07:24	06:13	05:55	04:55	04:38	05:12	06:10	07:10	08:09	08:13	08:49
	16:38	17:45	18:42	20:44	21:41	22:09	21:41	20:35	19:15	18:00	16:01	15:51
26	08:26	07:22	06:10	05:52	04:54	04:38	05:14	06:12	07:11	08:12	08:15	08:49
	16:40	17:47	18:44	20:46	21:42	22:09	21:40	20:32	19:12	17:57	16:00	15:52
27	08:25	07:19	06:08	05:50	04:53	04:38	05:15	06:14	07:13	08:14	08:16	08:50
	16:43	17:49	18:46	20:48	21:44	22:08	21:38	20:30	19:10	17:55	15:59	15:53
28	08:23	07:17	07:05	05:48	04:51	04:39	05:17	06:16	07:15	08:16	08:18	08:50
	16:45	17:51	19:48	20:50	21:45	22:08	21:36	20:27	19:07	17:53	15:58	15:54
29	08:21		07:03	05:45	04:50	04:40	05:19	06:18	07:17	08:18	08:20	08:50
	16:47		19:50	20:52	21:47	22:08	21:34	20:25	19:04	17:50	15:57	15:55
30	08:20		07:00	05:43	04:49	04:40	05:21	06:20	07:19	08:20	08:22	08:50
	16:49		19:52	20:54	21:48	22:08	21:32	20:22	19:02	17:48	15:56	15:56
31	08:18		06:57		04:48		05:23	06:22		07:22		08:50
	16:51		19:54		21:50		21:30	20:20		16:46		15:57
Potential sun hours	240	268	366	424	503	522	524	466	384	326	252	222
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Clachaig_Glen_210805

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Laura Craggs / laura.craggs@aecom.com

Calculated:
05/08/2021 17:52/3.0.651

SHADOW - Calendar per WTG

Calculation: SF ES Layout 210805WTG: 3 - Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 107.5 m (TOT: 185.0 m) (54)

Assumptions for shadow calculations

Reference year for calendar 2021

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:50	08:16	07:15	06:55	05:41	04:47	04:41	05:24	06:24	07:21	07:24	08:24
	15:58	16:53	17:53	19:56	20:56	21:51	22:07	21:29	20:17	18:59	16:44	15:55
2	08:50	08:14	07:12	06:52	05:39	04:45	04:42	05:26	06:26	07:23	07:26	08:25
	15:59	16:55	17:55	19:58	20:58	21:53	22:07	21:27	20:15	18:57	16:42	15:54
3	08:49	08:12	07:10	06:50	05:37	04:44	04:43	05:28	06:27	07:25	07:28	08:27
	16:01	16:57	17:57	20:00	21:00	21:54	22:07	21:25	20:12	18:54	16:40	15:53
4	08:49	08:11	07:07	06:47	05:34	04:44	04:44	05:30	06:29	07:27	07:30	08:28
	16:02	17:00	18:00	20:02	21:02	21:55	22:06	21:23	20:10	18:51	16:38	15:52
5	08:49	08:09	07:05	06:45	05:32	04:43	04:44	05:32	06:31	07:29	07:33	08:30
	16:03	17:02	18:02	20:04	21:04	21:56	22:05	21:21	20:07	18:49	16:35	15:52
6	08:48	08:07	07:02	06:42	05:30	04:42	04:45	05:34	06:33	07:31	07:35	08:31
	16:05	17:04	18:04	20:06	21:06	21:57	22:05	21:19	20:05	18:46	16:33	15:51
7	08:48	08:05	07:00	06:39	05:28	04:41	04:47	05:36	06:35	07:33	07:37	08:33
	16:06	17:06	18:06	20:08	21:08	21:59	22:04	21:16	20:02	18:44	16:31	15:51
8	08:47	08:03	06:57	06:37	05:26	04:40	04:48	05:37	06:37	07:35	07:39	08:34
	16:08	17:08	18:08	20:10	21:10	22:00	22:03	21:14	19:59	18:41	16:29	15:50
9	08:46	08:00	06:54	06:34	05:24	04:40	04:49	05:39	06:39	07:37	07:41	08:36
	16:09	17:10	18:10	20:12	21:12	22:01	22:02	21:12	19:57	18:39	16:27	15:50
10	08:46	07:58	06:52	06:32	05:22	04:39	04:50	05:41	06:41	07:39	07:43	08:37
	16:11	17:13	18:12	20:14	21:14	22:02	22:01	21:10	19:54	18:36	16:26	15:49
11	08:45	07:56	06:49	06:29	05:20	04:38	04:51	05:43	06:43	07:41	07:45	08:38
	16:12	17:15	18:14	20:16	21:16	22:02	22:00	21:08	19:52	18:34	16:24	15:49
12	08:44	07:54	06:47	06:27	05:18	04:38	04:52	05:45	06:45	07:43	07:47	08:39
	16:14	17:17	18:16	20:18	21:18	22:03	21:59	21:06	19:49	18:31	16:22	15:49
13	08:43	07:52	06:44	06:24	05:16	04:38	04:54	05:47	06:47	07:45	07:49	08:40
	16:16	17:19	18:18	20:20	21:20	22:04	21:58	21:03	19:46	18:29	16:20	15:48
14	08:42	07:50	06:42	06:22	05:14	04:37	04:55	05:49	06:49	07:47	07:51	08:42
	16:17	17:21	18:20	20:22	21:22	22:05	21:57	21:01	19:44	18:26	16:18	15:48
15	08:41	07:48	06:39	06:19	05:12	04:37	04:56	05:51	06:50	07:49	07:53	08:43
	16:19	17:23	18:22	20:24	21:23	22:06	21:56	20:59	19:41	18:24	16:17	15:48
16	08:40	07:45	06:36	06:17	05:10	04:37	04:58	05:53	06:52	07:51	07:55	08:43
	16:21	17:26	18:24	20:26	21:25	22:06	21:55	20:56	19:39	18:21	16:15	15:48
17	08:39	07:43	06:34	06:14	05:08	04:37	04:59	05:55	06:54	07:53	07:57	08:44
	16:23	17:28	18:26	20:28	21:27	22:07	21:53	20:54	19:36	18:19	16:13	15:48
18	08:38	07:41	06:31	06:12	05:07	04:36	05:01	05:57	06:56	07:55	07:59	08:45
	16:25	17:30	18:28	20:31	21:29	22:07	21:52	20:52	19:33	18:16	16:12	15:48
19	08:36	07:38	06:29	06:09	05:05	04:36	05:02	05:59	06:58	07:57	08:01	08:46
	16:27	17:32	18:30	20:33	21:31	22:08	21:51	20:49	19:31	18:14	16:10	15:49
20	08:35	07:36	06:26	06:07	05:03	04:37	05:04	06:00	07:00	07:59	08:03	08:47
	16:29	17:34	18:32	20:35	21:32	22:08	21:49	20:47	19:28	18:11	16:08	15:49
21	08:34	07:34	06:23	06:04	05:02	04:37	05:06	06:02	07:02	08:01	08:05	08:47
	16:30	17:36	18:34	20:37	21:34	22:08	21:48	20:45	19:25	18:09	16:07	15:49
22	08:32	07:31	06:21	06:02	05:00	04:37	05:07	06:04	07:04	08:03	08:07	08:48
	16:32	17:38	18:36	20:39	21:36	22:08	21:46	20:42	19:23	18:07	16:06	15:50
23	08:31	07:29	06:18	06:00	04:58	04:37	05:09	06:06	07:06	08:05	08:09	08:48
	16:34	17:41	18:38	20:41	21:38	22:09	21:45	20:40	19:20	18:04	16:04	15:50
24	08:30	07:27	06:16	05:57	04:57	04:37	05:10	06:08	07:08	08:07	08:11	08:49
	16:36	17:43	18:40	20:43	21:39	22:09	21:43	20:37	19:18	18:02	16:03	15:51
25	08:28	07:24	06:13	05:55	04:55	04:38	05:12	06:10	07:10	08:10	08:13	08:49
	16:39	17:45	18:42	20:45	21:41	22:09	21:41	20:35	19:15	18:00	16:02	15:52
26	08:26	07:22	06:10	05:52	04:54	04:38	05:14	06:12	07:12	08:12	08:15	08:49
	16:41	17:47	18:44	20:47	21:42	22:09	21:40	20:32	19:12	17:57	16:00	15:52
27	08:25	07:19	06:08	05:50	04:53	04:39	05:16	06:14	07:13	08:14	08:17	08:50
	16:43	17:49	18:46	20:49	21:44	22:09	21:38	20:30	19:10	17:55	15:59	15:53
28	08:23	07:17	07:05	05:48	04:51	04:39	05:17	06:16	07:15	08:16	08:18	08:50
	16:45	17:51	19:48	20:51	21:46	22:08	21:36	20:27	19:07	17:53	15:58	15:54
29	08:21		07:03	05:45	04:50	04:40	05:19	06:18	07:17	08:18	08:20	08:50
	16:47		19:50	20:53	21:47	22:08	21:34	20:25	19:04	17:50	15:57	15:55
30	08:20		07:00	05:43	04:49	04:40	05:21	06:20	07:19	08:20	08:22	08:50
	16:49		19:52	20:55	21:48	22:08	21:32	20:22	19:02	17:48	15:56	15:56
31	08:18		06:57		04:48		05:23	06:22		07:22		08:50
	16:51		19:54		21:50		21:31	20:20		16:46		15:57
Potential sun hours	240	268	366	424	503	522	524	466	384	326	252	222
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Clachaig_Glen_210805

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Laura Craggs / laura.craggs@aecom.com

Calculated:
05/08/2021 17:52/3.0.651

SHADOW - Calendar per WTG

Calculation: SF ES Layout 210805WTG: 4 - Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 107.5 m (TOT: 185.0 m) (55)

Assumptions for shadow calculations

Reference year for calendar 2021

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:50	08:16	07:15	06:55	05:41	04:47	04:41	05:25	06:24	07:21	07:24	08:24
	15:58	16:53	17:53	19:56	20:57	21:51	22:07	21:29	20:17	18:59	16:44	15:55
2	08:50	08:14	07:12	06:52	05:39	04:46	04:42	05:26	06:26	07:23	07:26	08:25
	15:59	16:55	17:55	19:58	20:58	21:53	22:07	21:27	20:15	18:57	16:42	15:54
3	08:49	08:12	07:10	06:50	05:37	04:45	04:43	05:28	06:27	07:25	07:28	08:27
	16:01	16:57	17:57	20:00	21:00	21:54	22:07	21:25	20:12	18:54	16:40	15:53
4	08:49	08:11	07:07	06:47	05:34	04:44	04:44	05:30	06:29	07:27	07:30	08:28
	16:02	17:00	18:00	20:02	21:02	21:55	22:06	21:23	20:10	18:51	16:38	15:52
5	08:49	08:09	07:05	06:45	05:32	04:43	04:45	05:32	06:31	07:29	07:33	08:30
	16:03	17:02	18:02	20:04	21:04	21:56	22:05	21:21	20:07	18:49	16:35	15:52
6	08:48	08:07	07:02	06:42	05:30	04:42	04:46	05:34	06:33	07:31	07:35	08:31
	16:05	17:04	18:04	20:06	21:06	21:58	22:05	21:19	20:05	18:46	16:33	15:51
7	08:48	08:05	07:00	06:39	05:28	04:41	04:47	05:36	06:35	07:33	07:37	08:33
	16:06	17:06	18:06	20:08	21:08	21:59	22:04	21:16	20:02	18:44	16:31	15:51
8	08:47	08:03	06:57	06:37	05:26	04:40	04:48	05:38	06:37	07:35	07:39	08:34
	16:08	17:08	18:08	20:10	21:10	22:00	22:03	21:14	19:59	18:41	16:29	15:50
9	08:46	08:00	06:54	06:34	05:24	04:40	04:49	05:39	06:39	07:37	07:41	08:36
	16:09	17:10	18:10	20:12	21:12	22:01	22:02	21:12	19:57	18:39	16:28	15:50
10	08:46	07:58	06:52	06:32	05:22	04:39	04:50	05:41	06:41	07:39	07:43	08:37
	16:11	17:13	18:12	20:14	21:14	22:02	22:01	21:10	19:54	18:36	16:26	15:49
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	16:12	17:15	18:14	20:16	21:16	22:03	22:00	21:08	19:52	18:34	16:24	15:49
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	16:14	17:17	18:16	20:18	21:18	22:03	21:59	21:06	19:49	18:31	16:22	15:49
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	16:16	17:19	18:18	20:20	21:20	22:04	21:58	21:03	19:46	18:29	16:20	15:48
14	08:42	07:50	06:42	06:22	05:14	04:37	04:55	05:49	06:49	07:47	07:51	08:42
	16:17	17:21	18:20	20:22	21:22	22:05	21:57	21:01	19:44	18:26	16:18	15:48
15	08:41	07:48	06:39	06:19	05:12	04:37	04:57	05:51	06:50	07:49	07:53	08:43
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16	08:40	07:45	06:36	06:17	05:10	04:37	04:58	05:53	06:52	07:51	07:55	08:43
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17	08:39	07:43	06:34	06:14	05:08	04:37	04:59	05:55	06:54	07:53	07:57	08:44
	16:23	17:28	18:26	20:29	21:27	22:07	21:53	20:54	19:36	18:19	16:13	15:48
18	08:38	07:41	06:31	06:12	05:07	04:37	05:01	05:57	06:56	07:55	07:59	08:45
	16:25	17:30	18:28	20:31	21:29	22:07	21:52	20:52	19:33	18:16	16:12	15:49
19	08:37	07:38	06:29	06:09	05:05	04:37	05:02	05:59	06:58	07:57	08:01	08:46
	16:27	17:32	18:30	20:33	21:31	22:08	21:51	20:49	19:31	18:14	16:10	15:49
20	08:35	07:36	06:26	06:07	05:03	04:37	05:04	06:01	07:00	07:59	08:03	08:47
	16:29	17:34	18:32	20:35	21:32	22:08	21:49	20:47	19:28	18:11	16:09	15:49
21	08:34	07:34	06:24	06:04	05:02	04:37	05:06	06:02	07:02	08:01	08:05	08:47
	16:31	17:36	18:34	20:37	21:34	22:08	21:48	20:45	19:25	18:09	16:07	15:49
22	08:32	07:31	06:21	06:02	05:00	04:37	05:07	06:04	07:04	08:03	08:07	08:48
	16:33	17:38	18:36	20:39	21:36	22:08	21:46	20:42	19:23	18:07	16:06	15:50
23	08:31	07:29	06:18	06:00	04:59	04:37	05:09	06:06	07:06	08:05	08:09	08:48
	16:35	17:41	18:38	20:41	21:38	22:09	21:45	20:40	19:20	18:04	16:04	15:50
24	08:30	07:27	06:16	05:57	04:57	04:37	05:10	06:08	07:08	08:07	08:11	08:49
	16:37	17:43	18:40	20:43	21:39	22:09	21:43	20:37	19:18	18:02	16:03	15:51
25	08:28	07:24	06:13	05:55	04:56	04:38	05:12	06:10	07:10	08:10	08:13	08:49
	16:39	17:45	18:42	20:45	21:41	22:09	21:41	20:35	19:15	18:00	16:02	15:52
26	08:26	07:22	06:10	05:52	04:54	04:38	05:14	06:12	07:12	08:12	08:15	08:49
	16:41	17:47	18:44	20:47	21:42	22:09	21:40	20:32	19:12	17:57	16:00	15:52
27	08:25	07:19	06:08	05:50	04:53	04:39	05:16	06:14	07:14	08:14	08:17	08:50
	16:43	17:49	18:46	20:49	21:44	22:09	21:38	20:30	19:10	17:55	15:59	15:53
28	08:23	07:17	07:05	05:48	04:51	04:39	05:17	06:16	07:15	08:16	08:18	08:50
	16:45	17:51	19:48	20:51	21:46	22:08	21:36	20:27	19:07	17:53	15:58	15:54
29	08:21		07:03	05:46	04:50	04:40	05:19	06:18	07:17	08:18	08:20	08:50
	16:47		19:50	20:53	21:47	22:08	21:34	20:25	19:04	17:51	15:57	15:55
30	08:20		07:00	05:43	04:49	04:40	05:21	06:20	07:19	08:20	08:22	08:50
	16:49		19:52	20:55	21:48	22:08	21:32	20:22	19:02	17:48	15:56	15:56
31	08:18		06:57		04:48		05:23	06:22		07:22		08:50
	16:51		19:54		21:50		21:31	20:20		16:46		15:57
Potential sun hours	240	268	366	424	503	522	524	466	384	326	252	222
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Clachaig_Glen_210805

Licensed user:
AECOM Professional Services LLP Limited
First Floor, One Trinity Gardens, Quayside
GB-NEWCASTLE upon Tyne NE1 2HF
+44 191 224 6610
Laura Craggs / laura.craggs@aecom.com

Calculated:
05/08/2021 17:52/3.0.651

SHADOW - Calendar per WTG

Calculation: SF ES Layout 210805WTG: 5 - Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 107.5 m (TOT: 185.0 m) (56)

Assumptions for shadow calculations

Reference year for calendar 2021

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:50	08:16	07:14	06:55	05:41	04:47	04:41	05:24	06:24	07:21	07:24	08:23
	15:58	16:53	17:53	19:56	20:56	21:51	22:07	21:29	20:17	18:59	16:44	15:55
2	08:50	08:14	07:12	06:52	05:39	04:45	04:42	05:26	06:25	07:23	07:26	08:25
	15:59	16:55	17:55	19:58	20:58	21:53	22:07	21:27	20:15	18:57	16:42	15:54
3	08:49	08:12	07:09	06:50	05:36	04:44	04:43	05:28	06:27	07:25	07:28	08:27
	16:01	16:57	17:57	20:00	21:00	21:54	22:06	21:25	20:12	18:54	16:40	15:53
4	08:49	08:10	07:07	06:47	05:34	04:43	04:43	05:30	06:29	07:27	07:30	08:28
	16:02	17:00	17:59	20:02	21:02	21:55	22:06	21:23	20:10	18:51	16:37	15:52
5	08:49	08:09	07:04	06:44	05:32	04:43	04:44	05:32	06:31	07:29	07:32	08:30
	16:03	17:02	18:02	20:04	21:04	21:56	22:05	21:21	20:07	18:49	16:35	15:52
6	08:48	08:07	07:02	06:42	05:30	04:42	04:45	05:34	06:33	07:31	07:35	08:31
	16:05	17:04	18:04	20:06	21:06	21:57	22:05	21:19	20:04	18:46	16:33	15:51
7	08:48	08:05	06:59	06:39	05:28	04:41	04:46	05:36	06:35	07:33	07:37	08:33
	16:06	17:06	18:06	20:08	21:08	21:59	22:04	21:16	20:02	18:44	16:31	15:50
8	08:47	08:02	06:57	06:37	05:26	04:40	04:48	05:37	06:37	07:35	07:39	08:34
	16:08	17:08	18:08	20:10	21:10	22:00	22:03	21:14	19:59	18:41	16:29	15:50
9	08:46	08:00	06:54	06:34	05:24	04:40	04:49	05:39	06:39	07:37	07:41	08:36
	16:09	17:10	18:10	20:12	21:12	22:01	22:02	21:12	19:57	18:39	16:27	15:49
10	08:46	07:58	06:52	06:32	05:22	04:39	04:50	05:41	06:41	07:39	07:43	08:37
	16:11	17:12	18:12	20:14	21:14	22:02	22:01	21:10	19:54	18:36	16:26	15:49
11	08:45	07:56	06:49	06:29	05:20	04:38	04:51	05:43	06:43	07:41	07:45	08:38
	16:12	17:15	18:14	20:16	21:16	22:02	22:00	21:08	19:52	18:34	16:24	15:49
12	08:44	07:54	06:47	06:27	05:18	04:38	04:52	05:45	06:45	07:43	07:47	08:39
	16:14	17:17	18:16	20:18	21:18	22:03	21:59	21:06	19:49	18:31	16:22	15:49
13	08:43	07:52	06:44	06:24	05:16	04:38	04:54	05:47	06:47	07:45	07:49	08:40
	16:16	17:19	18:18	20:20	21:20	22:04	21:58	21:03	19:46	18:29	16:20	15:48
14	08:42	07:50	06:42	06:22	05:14	04:37	04:55	05:49	06:48	07:47	07:51	08:41
	16:17	17:21	18:20	20:22	21:22	22:05	21:57	21:01	19:44	18:26	16:18	15:48
15	08:41	07:47	06:39	06:19	05:12	04:37	04:56	05:51	06:50	07:49	07:53	08:42
	16:19	17:23	18:22	20:24	21:23	22:05	21:56	20:59	19:41	18:24	16:16	15:48
16	08:40	07:45	06:36	06:17	05:10	04:37	04:58	05:53	06:52	07:51	07:55	08:43
	16:21	17:25	18:24	20:26	21:25	22:06	21:55	20:56	19:38	18:21	16:15	15:48
17	08:39	07:43	06:34	06:14	05:08	04:37	04:59	05:55	06:54	07:53	07:57	08:44
	16:23	17:28	18:26	20:28	21:27	22:07	21:53	20:54	19:36	18:19	16:13	15:48
18	08:38	07:41	06:31	06:12	05:07	04:36	05:01	05:57	06:56	07:55	07:59	08:45
	16:25	17:30	18:28	20:30	21:29	22:07	21:52	20:52	19:33	18:16	16:12	15:48
19	08:36	07:38	06:29	06:09	05:05	04:36	05:02	05:58	06:58	07:57	08:01	08:46
	16:27	17:32	18:30	20:32	21:31	22:07	21:51	20:49	19:31	18:14	16:10	15:49
20	08:35	07:36	06:26	06:07	05:03	04:36	05:04	06:00	07:00	07:59	08:03	08:47
	16:28	17:34	18:32	20:34	21:32	22:08	21:49	20:47	19:28	18:11	16:08	15:49
21	08:34	07:34	06:23	06:04	05:02	04:37	05:05	06:02	07:02	08:01	08:05	08:47
	16:30	17:36	18:34	20:36	21:34	22:08	21:48	20:45	19:25	18:09	16:07	15:49
22	08:32	07:31	06:21	06:02	05:00	04:37	05:07	06:04	07:04	08:03	08:07	08:48
	16:32	17:38	18:36	20:38	21:36	22:08	21:46	20:42	19:23	18:07	16:05	15:50
23	08:31	07:29	06:18	05:59	04:58	04:37	05:09	06:06	07:06	08:05	08:09	08:48
	16:34	17:41	18:38	20:40	21:38	22:08	21:45	20:40	19:20	18:04	16:04	15:50
24	08:29	07:27	06:16	05:57	04:57	04:37	05:10	06:08	07:08	08:07	08:11	08:49
	16:36	17:43	18:40	20:42	21:39	22:09	21:43	20:37	19:17	18:02	16:03	15:51
25	08:28	07:24	06:13	05:55	04:55	04:38	05:12	06:10	07:10	08:09	08:13	08:49
	16:38	17:45	18:42	20:44	21:41	22:09	21:41	20:35	19:15	18:00	16:01	15:52
26	08:26	07:22	06:10	05:52	04:54	04:38	05:14	06:12	07:12	08:12	08:15	08:49
	16:41	17:47	18:44	20:46	21:42	22:09	21:40	20:32	19:12	17:57	16:00	15:52
27	08:25	07:19	06:08	05:50	04:53	04:38	05:16	06:14	07:13	08:14	08:16	08:50
	16:43	17:49	18:46	20:48	21:44	22:08	21:38	20:30	19:10	17:55	15:59	15:53
28	08:23	07:17	07:05	05:48	04:51	04:39	05:17	06:16	07:15	08:16	08:18	08:50
	16:45	17:51	19:48	20:50	21:45	22:08	21:36	20:27	19:07	17:53	15:58	15:54
29	08:21		07:03	05:45	04:50	04:40	05:19	06:18	07:17	08:18	08:20	08:50
	16:47		19:50	20:52	21:47	22:08	21:34	20:25	19:04	17:50	15:57	15:55
30	08:20		07:00	05:43	04:49	04:40	05:21	06:20	07:19	08:20	08:22	08:50
	16:49		19:52	20:54	21:48	22:08	21:32	20:22	19:02	17:48	15:56	15:56
31	08:18		06:57		04:48		05:23	06:22		07:22		08:50
	16:51		19:54		21:50		21:30	20:20		16:46		15:57
Potential sun hours	240	268	366	424	503	522	524	466	384	326	252	222
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Clachaig_Glen_210805

Licensed user:
AECOM Professional Services LLP Limited
First Floor, One Trinity Gardens, Quayside
GB-NEWCASTLE upon Tyne NE1 2HF
+44 191 224 6610
Laura Craggs / laura.craggs@aecom.com

Calculated:
05/08/2021 17:52/3.0.651

SHADOW - Calendar per WTG

Calculation: SF ES Layout 210805WTG: 6 - Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 107.5 m (TOT: 185.0 m) (57)

Assumptions for shadow calculations

Reference year for calendar 2021

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:50	08:16	07:15	06:55	05:41	04:47	04:41	05:24	06:24	07:21	07:24	08:23
	15:58	16:53	17:53	19:56	20:56	21:51	22:07	21:29	20:17	18:59	16:44	15:55
2	08:50	08:14	07:12	06:52	05:39	04:46	04:42	05:26	06:26	07:23	07:26	08:25
	15:59	16:55	17:55	19:58	20:58	21:53	22:07	21:27	20:15	18:57	16:42	15:54
3	08:49	08:12	07:10	06:50	05:37	04:45	04:43	05:28	06:27	07:25	07:28	08:27
	16:01	16:57	17:57	20:00	21:00	21:54	22:06	21:25	20:12	18:54	16:40	15:53
4	08:49	08:10	07:07	06:47	05:34	04:44	04:44	05:30	06:29	07:27	07:30	08:28
	16:02	17:00	18:00	20:02	21:02	21:55	22:06	21:23	20:10	18:51	16:38	15:52
5	08:49	08:09	07:05	06:45	05:32	04:43	04:45	05:32	06:31	07:29	07:33	08:30
	16:03	17:02	18:02	20:04	21:04	21:56	22:05	21:21	20:07	18:49	16:35	15:52
6	08:48	08:07	07:02	06:42	05:30	04:42	04:46	05:34	06:33	07:31	07:35	08:31
	16:05	17:04	18:04	20:06	21:06	21:57	22:05	21:19	20:05	18:46	16:33	15:51
7	08:48	08:05	07:00	06:39	05:28	04:41	04:47	05:36	06:35	07:33	07:37	08:33
	16:06	17:06	18:06	20:08	21:08	21:59	22:04	21:16	20:02	18:44	16:31	15:51
8	08:47	08:03	06:57	06:37	05:26	04:40	04:48	05:38	06:37	07:35	07:39	08:34
	16:08	17:08	18:08	20:10	21:10	22:00	22:03	21:14	19:59	18:41	16:29	15:50
9	08:46	08:00	06:54	06:34	05:24	04:40	04:49	05:39	06:39	07:37	07:41	08:36
	16:09	17:10	18:10	20:12	21:12	22:01	22:02	21:12	19:57	18:39	16:27	15:50
10	08:46	07:58	06:52	06:32	05:22	04:39	04:50	05:41	06:41	07:39	07:43	08:37
	16:11	17:13	18:12	20:14	21:14	22:02	22:01	21:10	19:54	18:36	16:26	15:49
11	08:45	07:56	06:49	06:29	05:20	04:39	04:51	05:43	06:43	07:41	07:45	08:38
	16:12	17:15	18:14	20:16	21:16	22:02	22:00	21:08	19:52	18:34	16:24	15:49
12	08:44	07:54	06:47	06:27	05:18	04:38	04:52	05:45	06:45	07:43	07:47	08:39
	16:14	17:17	18:16	20:18	21:18	22:03	21:59	21:06	19:49	18:31	16:22	15:49
13	08:43	07:52	06:44	06:24	05:16	04:38	04:54	05:47	06:47	07:45	07:49	08:40
	16:16	17:19	18:18	20:20	21:20	22:04	21:58	21:03	19:46	18:29	16:20	15:48
14	08:42	07:50	06:42	06:22	05:14	04:37	04:55	05:49	06:49	07:47	07:51	08:41
	16:17	17:21	18:20	20:22	21:22	22:05	21:57	21:01	19:44	18:26	16:18	15:48
15	08:41	07:48	06:39	06:19	05:12	04:37	04:57	05:51	06:50	07:49	07:53	08:42
	16:19	17:23	18:22	20:24	21:23	22:05	21:56	20:59	19:41	18:24	16:17	15:48
16	08:40	07:45	06:36	06:17	05:10	04:37	04:58	05:53	06:52	07:51	07:55	08:43
	16:21	17:26	18:24	20:26	21:25	22:06	21:55	20:56	19:38	18:21	16:15	15:48
17	08:39	07:43	06:34	06:14	05:08	04:37	04:59	05:55	06:54	07:53	07:57	08:44
	16:23	17:28	18:26	20:28	21:27	22:07	21:53	20:54	19:36	18:19	16:13	15:48
18	08:38	07:41	06:31	06:12	05:07	04:37	05:01	05:57	06:56	07:55	07:59	08:45
	16:25	17:30	18:28	20:30	21:29	22:07	21:52	20:52	19:33	18:16	16:12	15:49
19	08:36	07:38	06:29	06:09	05:05	04:37	05:02	05:59	06:58	07:57	08:01	08:46
	16:27	17:32	18:30	20:32	21:31	22:07	21:51	20:49	19:31	18:14	16:10	15:49
20	08:35	07:36	06:26	06:07	05:03	04:37	05:04	06:00	07:00	07:59	08:03	08:47
	16:29	17:34	18:32	20:35	21:32	22:08	21:49	20:47	19:28	18:11	16:08	15:49
21	08:34	07:34	06:23	06:04	05:02	04:37	05:06	06:02	07:02	08:01	08:05	08:47
	16:31	17:36	18:34	20:37	21:34	22:08	21:48	20:45	19:25	18:09	16:07	15:49
22	08:32	07:31	06:21	06:02	05:00	04:37	05:07	06:04	07:04	08:03	08:07	08:48
	16:32	17:38	18:36	20:39	21:36	22:08	21:46	20:42	19:23	18:07	16:06	15:50
23	08:31	07:29	06:18	06:00	04:59	04:37	05:09	06:06	07:06	08:05	08:09	08:48
	16:34	17:41	18:38	20:41	21:38	22:09	21:45	20:40	19:20	18:04	16:04	15:50
24	08:30	07:27	06:16	05:57	04:57	04:37	05:10	06:08	07:08	08:07	08:11	08:49
	16:37	17:43	18:40	20:43	21:39	22:09	21:43	20:37	19:18	18:02	16:03	15:51
25	08:28	07:24	06:13	05:55	04:56	04:38	05:12	06:10	07:10	08:10	08:13	08:49
	16:39	17:45	18:42	20:45	21:41	22:09	21:41	20:35	19:15	18:00	16:02	15:52
26	08:26	07:22	06:10	05:52	04:54	04:38	05:14	06:12	07:12	08:12	08:15	08:49
	16:41	17:47	18:44	20:47	21:42	22:09	21:40	20:32	19:12	17:57	16:00	15:52
27	08:25	07:19	06:08	05:50	04:53	04:39	05:16	06:14	07:13	08:14	08:17	08:50
	16:43	17:49	18:46	20:49	21:44	22:08	21:38	20:30	19:10	17:55	15:59	15:53
28	08:23	07:17	07:05	05:48	04:51	04:39	05:17	06:16	07:15	08:16	08:18	08:50
	16:45	17:51	19:48	20:51	21:45	22:08	21:36	20:27	19:07	17:53	15:58	15:54
29	08:21		07:03	05:45	04:50	04:40	05:19	06:18	07:17	08:18	08:20	08:50
	16:47		19:50	20:52	21:47	22:08	21:34	20:25	19:04	17:50	15:57	15:55
30	08:20		07:00	05:43	04:49	04:40	05:21	06:20	07:19	08:20	08:22	08:50
	16:49		19:52	20:54	21:48	22:08	21:32	20:22	19:02	17:48	15:56	15:56
31	08:18		06:57		04:48		05:23	06:22		07:22		08:50
	16:51		19:54		21:50		21:31	20:20		16:46		15:57
Potential sun hours	240	268	366	424	503	522	524	466	384	326	252	222
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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Laura Craggs / laura.craggs@aecom.com
Calculated:
05/08/2021 17:52/3.0.651

SHADOW - Calendar per WTG

Calculation: SF ES Layout 210805WTG: 7 - Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 122.5 m (TOT: 200.0 m) (58)

Assumptions for shadow calculations

Reference year for calendar 2021

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:50	08:16	07:14	06:55	05:41	04:47	04:41	05:24	06:24	07:21	07:24	08:23
	15:58	16:53	17:53	19:56	20:56	21:51	22:07	21:29	20:17	18:59	16:44	15:55
2	08:50	08:14	07:12	06:52	05:39	04:45	04:42	05:26	06:25	07:23	07:26	08:25
	15:59	16:55	17:55	19:58	20:58	21:53	22:07	21:27	20:15	18:57	16:42	15:54
3	08:49	08:12	07:10	06:50	05:36	04:44	04:43	05:28	06:27	07:25	07:28	08:27
	16:01	16:57	17:57	20:00	21:00	21:54	22:06	21:25	20:12	18:54	16:40	15:53
4	08:49	08:10	07:07	06:47	05:34	04:44	04:44	05:30	06:29	07:27	07:30	08:28
	16:02	17:00	18:00	20:02	21:02	21:55	22:06	21:23	20:10	18:51	16:37	15:52
5	08:49	08:09	07:05	06:44	05:32	04:43	04:44	05:32	06:31	07:29	07:32	08:30
	16:03	17:02	18:02	20:04	21:04	21:56	22:05	21:21	20:07	18:49	16:35	15:52
6	08:48	08:07	07:02	06:42	05:30	04:42	04:45	05:34	06:33	07:31	07:35	08:31
	16:05	17:04	18:04	20:06	21:06	21:57	22:05	21:19	20:05	18:46	16:33	15:51
7	08:48	08:05	06:59	06:39	05:28	04:41	04:46	05:36	06:35	07:33	07:37	08:33
	16:06	17:06	18:06	20:08	21:08	21:59	22:04	21:16	20:02	18:44	16:31	15:50
8	08:47	08:02	06:57	06:37	05:26	04:40	04:48	05:37	06:37	07:35	07:39	08:34
	16:08	17:08	18:08	20:10	21:10	22:00	22:03	21:14	19:59	18:41	16:29	15:50
9	08:46	08:00	06:54	06:34	05:24	04:40	04:49	05:39	06:39	07:37	07:41	08:36
	16:09	17:10	18:10	20:12	21:12	22:01	22:02	21:12	19:57	18:39	16:27	15:50
10	08:46	07:58	06:52	06:32	05:22	04:39	04:50	05:41	06:41	07:39	07:43	08:37
	16:11	17:13	18:12	20:14	21:14	22:02	22:01	21:10	19:54	18:36	16:26	15:49
11	08:45	07:56	06:49	06:29	05:20	04:38	04:51	05:43	06:43	07:41	07:45	08:38
	16:12	17:15	18:14	20:16	21:16	22:02	22:00	21:08	19:52	18:34	16:24	15:49
12	08:44	07:54	06:47	06:27	05:18	04:38	04:52	05:45	06:45	07:43	07:47	08:39
	16:14	17:17	18:16	20:18	21:18	22:03	21:59	21:06	19:49	18:31	16:22	15:49
13	08:43	07:52	06:44	06:24	05:16	04:38	04:54	05:47	06:47	07:45	07:49	08:40
	16:16	17:19	18:18	20:20	21:20	22:04	21:58	21:03	19:46	18:29	16:20	15:48
14	08:42	07:50	06:42	06:22	05:14	04:37	04:55	05:49	06:48	07:47	07:51	08:41
	16:17	17:21	18:20	20:22	21:22	22:05	21:57	21:01	19:44	18:26	16:18	15:48
15	08:41	07:47	06:39	06:19	05:12	04:37	04:56	05:51	06:50	07:49	07:53	08:42
	16:19	17:23	18:22	20:24	21:23	22:05	21:56	20:59	19:41	18:24	16:16	15:48
16	08:40	07:45	06:36	06:17	05:10	04:37	04:58	05:53	06:52	07:51	07:55	08:43
	16:21	17:26	18:24	20:26	21:25	22:06	21:55	20:56	19:38	18:21	16:15	15:48
17	08:39	07:43	06:34	06:14	05:08	04:37	04:59	05:55	06:54	07:53	07:57	08:44
	16:23	17:28	18:26	20:28	21:27	22:07	21:53	20:54	19:36	18:19	16:13	15:48
18	08:38	07:41	06:31	06:12	05:07	04:36	05:01	05:57	06:56	07:55	07:59	08:45
	16:25	17:30	18:28	20:30	21:29	22:07	21:52	20:52	19:33	18:16	16:12	15:48
19	08:36	07:38	06:29	06:09	05:05	04:36	05:02	05:59	06:58	07:57	08:01	08:46
	16:27	17:32	18:30	20:32	21:31	22:07	21:51	20:49	19:31	18:14	16:10	15:49
20	08:35	07:36	06:26	06:07	05:03	04:36	05:04	06:00	07:00	07:59	08:03	08:47
	16:29	17:34	18:32	20:34	21:32	22:08	21:49	20:47	19:28	18:11	16:08	15:49
21	08:34	07:34	06:23	06:04	05:02	04:37	05:06	06:02	07:02	08:01	08:05	08:47
	16:30	17:36	18:34	20:36	21:34	22:08	21:48	20:45	19:25	18:09	16:07	15:49
22	08:32	07:31	06:21	06:02	05:00	04:37	05:07	06:04	07:04	08:03	08:07	08:48
	16:32	17:38	18:36	20:38	21:36	22:08	21:46	20:42	19:23	18:07	16:06	15:50
23	08:31	07:29	06:18	05:59	04:58	04:37	05:09	06:06	07:06	08:05	08:09	08:48
	16:34	17:41	18:38	20:40	21:38	22:08	21:45	20:40	19:20	18:04	16:04	15:50
24	08:29	07:27	06:16	05:57	04:57	04:37	05:10	06:08	07:08	08:07	08:11	08:49
	16:36	17:43	18:40	20:42	21:39	22:09	21:43	20:37	19:17	18:02	16:03	15:51
25	08:28	07:24	06:13	05:55	04:55	04:38	05:12	06:10	07:10	08:09	08:13	08:49
	16:38	17:45	18:42	20:44	21:41	22:09	21:41	20:35	19:15	18:00	16:02	15:52
26	08:26	07:22	06:10	05:52	04:54	04:38	05:14	06:12	07:12	08:12	08:15	08:49
	16:41	17:47	18:44	20:46	21:42	22:09	21:40	20:32	19:12	17:57	16:00	15:52
27	08:25	07:19	06:08	05:50	04:53	04:39	05:16	06:14	07:13	08:14	08:16	08:50
	16:43	17:49	18:46	20:48	21:44	22:08	21:38	20:30	19:10	17:55	15:59	15:53
28	08:23	07:17	07:05	05:48	04:51	04:39	05:17	06:16	07:15	08:16	08:18	08:50
	16:45	17:51	19:48	20:50	21:45	22:08	21:36	20:27	19:07	17:53	15:58	15:54
29	08:21		07:03	05:45	04:50	04:40	05:19	06:18	07:17	08:18	08:20	08:50
	16:47		19:50	20:52	21:47	22:08	21:34	20:25	19:04	17:50	15:57	15:55
30	08:20		07:00	05:43	04:49	04:40	05:21	06:20	07:19	08:20	08:22	08:50
	16:49		19:52	20:54	21:48	22:08	21:32	20:22	19:02	17:48	15:56	15:56
31	08:18		06:57		04:48		05:23	06:22		07:22		08:50
	16:51		19:54		21:50		21:30	20:20		16:46		15:57
Potential sun hours	240	268	366	424	503	522	524	466	384	326	252	222
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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Laura Craggs / laura.craggs@aecom.com
Calculated:
05/08/2021 17:52/3.0.651

SHADOW - Calendar per WTG

Calculation: SF ES Layout 210805WTG: 8 - Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 107.5 m (TOT: 185.0 m) (59)

Assumptions for shadow calculations

Reference year for calendar 2021

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:50	08:16	07:15	06:55	05:41	04:47	04:41	05:25	06:24	07:21	07:24	08:24
	15:58	16:53	17:53	19:56	20:56	21:51	22:07	21:29	20:17	18:59	16:44	15:55
2	08:50	08:14	07:12	06:52	05:39	04:46	04:42	05:26	06:26	07:23	07:26	08:25
	16:00	16:55	17:55	19:58	20:58	21:53	22:07	21:27	20:15	18:57	16:42	15:54
3	08:49	08:12	07:10	06:50	05:37	04:45	04:43	05:28	06:27	07:25	07:28	08:27
	16:01	16:57	17:57	20:00	21:00	21:54	22:07	21:25	20:12	18:54	16:40	15:53
4	08:49	08:11	07:07	06:47	05:34	04:44	04:44	05:30	06:29	07:27	07:30	08:28
	16:02	17:00	18:00	20:02	21:02	21:55	22:06	21:23	20:10	18:52	16:38	15:53
5	08:49	08:09	07:05	06:45	05:32	04:43	04:45	05:32	06:31	07:29	07:33	08:30
	16:03	17:02	18:02	20:04	21:04	21:56	22:05	21:21	20:07	18:49	16:36	15:52
6	08:48	08:07	07:02	06:42	05:30	04:42	04:46	05:34	06:33	07:31	07:35	08:31
	16:05	17:04	18:04	20:06	21:06	21:57	22:05	21:19	20:05	18:46	16:33	15:51
7	08:48	08:05	07:00	06:39	05:28	04:41	04:47	05:36	06:35	07:33	07:37	08:33
	16:06	17:06	18:06	20:08	21:08	21:59	22:04	21:16	20:02	18:44	16:31	15:51
8	08:47	08:03	06:57	06:37	05:26	04:40	04:48	05:38	06:37	07:35	07:39	08:34
	16:08	17:08	18:08	20:10	21:10	22:00	22:03	21:14	19:59	18:41	16:29	15:50
9	08:46	08:00	06:54	06:34	05:24	04:40	04:49	05:39	06:39	07:37	07:41	08:36
	16:09	17:10	18:10	20:12	21:12	22:01	22:02	21:12	19:57	18:39	16:28	15:50
10	08:46	07:58	06:52	06:32	05:22	04:39	04:50	05:41	06:41	07:39	07:43	08:37
	16:11	17:13	18:12	20:14	21:14	22:02	22:01	21:10	19:54	18:36	16:26	15:49
11	08:45	07:56	06:49	06:29	05:20	04:39	04:51	05:43	06:43	07:41	07:45	08:38
	16:12	17:15	18:14	20:16	21:16	22:02	22:00	21:08	19:52	18:34	16:24	15:49
12	08:44	07:54	06:47	06:27	05:18	04:38	04:53	05:45	06:45	07:43	07:47	08:39
	16:14	17:17	18:16	20:18	21:18	22:03	21:59	21:06	19:49	18:31	16:22	15:49
13	08:43	07:52	06:44	06:24	05:16	04:38	04:54	05:47	06:47	07:45	07:49	08:40
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14	08:42	07:50	06:42	06:22	05:14	04:37	04:55	05:49	06:49	07:47	07:51	08:41
	16:17	17:21	18:20	20:22	21:22	22:05	21:57	21:01	19:44	18:26	16:18	15:48
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	16:19	17:23	18:22	20:25	21:23	22:05	21:56	20:59	19:41	18:24	16:17	15:48
16	08:40	07:45	06:37	06:17	05:10	04:37	04:58	05:53	06:52	07:51	07:55	08:43
	16:21	17:26	18:24	20:27	21:25	22:06	21:55	20:56	19:39	18:21	16:15	15:48
17	08:39	07:43	06:34	06:14	05:09	04:37	04:59	05:55	06:54	07:53	07:57	08:44
	16:23	17:28	18:26	20:29	21:27	22:07	21:53	20:54	19:36	18:19	16:13	15:48
18	08:38	07:41	06:31	06:12	05:07	04:37	05:01	05:57	06:56	07:55	07:59	08:45
	16:25	17:30	18:28	20:31	21:29	22:07	21:52	20:52	19:33	18:16	16:12	15:49
19	08:36	07:38	06:29	06:09	05:05	04:37	05:02	05:59	06:58	07:57	08:01	08:46
	16:27	17:32	18:30	20:33	21:31	22:08	21:51	20:49	19:31	18:14	16:10	15:49
20	08:35	07:36	06:26	06:07	05:03	04:37	05:04	06:01	07:00	07:59	08:03	08:47
	16:29	17:34	18:32	20:35	21:32	22:08	21:49	20:47	19:28	18:11	16:09	15:49
21	08:34	07:34	06:24	06:04	05:02	04:37	05:06	06:02	07:02	08:01	08:05	08:47
	16:31	17:36	18:34	20:37	21:34	22:08	21:48	20:45	19:25	18:09	16:07	15:49
22	08:32	07:31	06:21	06:02	05:00	04:37	05:07	06:04	07:04	08:03	08:07	08:48
	16:33	17:38	18:36	20:39	21:36	22:08	21:46	20:42	19:23	18:07	16:06	15:50
23	08:31	07:29	06:18	06:00	04:59	04:37	05:09	06:06	07:06	08:05	08:09	08:48
	16:35	17:41	18:38	20:41	21:38	22:09	21:45	20:40	19:20	18:04	16:04	15:50
24	08:30	07:27	06:16	05:57	04:57	04:37	05:11	06:08	07:08	08:07	08:11	08:49
	16:37	17:43	18:40	20:43	21:39	22:09	21:43	20:37	19:18	18:02	16:03	15:51
25	08:28	07:24	06:13	05:55	04:56	04:38	05:12	06:10	07:10	08:10	08:13	08:49
	16:39	17:45	18:42	20:45	21:41	22:09	21:41	20:35	19:15	18:00	16:02	15:52
26	08:26	07:22	06:11	05:52	04:54	04:38	05:14	06:12	07:12	08:12	08:15	08:49
	16:41	17:47	18:44	20:47	21:42	22:09	21:40	20:32	19:12	17:57	16:00	15:52
27	08:25	07:19	06:08	05:50	04:53	04:39	05:16	06:14	07:14	08:14	08:17	08:50
	16:43	17:49	18:46	20:49	21:44	22:09	21:38	20:30	19:10	17:55	15:59	15:53
28	08:23	07:17	07:05	05:48	04:51	04:39	05:17	06:16	07:15	08:16	08:18	08:50
	16:45	17:51	19:48	20:51	21:46	22:08	21:36	20:27	19:07	17:53	15:58	15:54
29	08:21		07:03	05:46	04:50	04:40	05:19	06:18	07:17	08:18	08:20	08:50
	16:47		19:50	20:53	21:47	22:08	21:34	20:25	19:04	17:51	15:57	15:55
30	08:20		07:00	05:43	04:49	04:40	05:21	06:20	07:19	08:20	08:22	08:50
	16:49		19:52	20:55	21:48	22:08	21:32	20:22	19:02	17:48	15:56	15:56
31	08:18		06:57		04:48		05:23	06:22		07:22		08:50
	16:51		19:54		21:50		21:31	20:20		16:46		15:57
Potential sun hours	240	268	366	424	503	522	524	466	384	326	252	222
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Clachaig_Glen_210805

Licensed user:
AECOM Professional Services LLP Limited
First Floor, One Trinity Gardens, Quayside
GB-NEWCASTLE upon Tyne NE1 2HF
+44 191 224 6610
Laura Craggs / laura.craggs@aecom.com

Calculated:
05/08/2021 17:52/3.0.651

SHADOW - Calendar per WTG

Calculation: SF ES Layout 210805WTG: 9 - Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 122.5 m (TOT: 200.0 m) (60)

Assumptions for shadow calculations

Reference year for calendar 2021

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:50	08:16	07:15	06:55	05:41	04:47	04:41	05:25	06:24	07:21	07:24	08:24
	15:58	16:53	17:53	19:56	20:57	21:51	22:07	21:29	20:17	18:59	16:44	15:55
2	08:50	08:14	07:12	06:52	05:39	04:46	04:42	05:26	06:26	07:23	07:26	08:25
	16:00	16:55	17:55	19:58	20:58	21:53	22:07	21:27	20:15	18:57	16:42	15:54
3	08:49	08:12	07:10	06:50	05:37	04:45	04:43	05:28	06:27	07:25	07:28	08:27
	16:01	16:58	17:58	20:00	21:00	21:54	22:07	21:25	20:12	18:54	16:40	15:53
4	08:49	08:11	07:07	06:47	05:34	04:44	04:44	05:30	06:29	07:27	07:30	08:28
	16:02	17:00	18:00	20:02	21:02	21:55	22:06	21:23	20:10	18:52	16:38	15:53
5	08:49	08:09	07:05	06:45	05:32	04:43	04:45	05:32	06:31	07:29	07:33	08:30
	16:03	17:02	18:02	20:04	21:04	21:56	22:05	21:21	20:07	18:49	16:36	15:52
6	08:48	08:07	07:02	06:42	05:30	04:42	04:46	05:34	06:33	07:31	07:35	08:31
	16:05	17:04	18:04	20:06	21:06	21:57	22:05	21:19	20:05	18:46	16:34	15:51
7	08:48	08:05	07:00	06:39	05:28	04:41	04:47	05:36	06:35	07:33	07:37	08:33
	16:06	17:06	18:06	20:08	21:08	21:59	22:04	21:16	20:02	18:44	16:31	15:51
8	08:47	08:03	06:57	06:37	05:26	04:40	04:48	05:38	06:37	07:35	07:39	08:34
	16:08	17:08	18:08	20:10	21:10	22:00	22:03	21:14	19:59	18:41	16:30	15:50
9	08:46	08:00	06:54	06:34	05:24	04:40	04:49	05:39	06:39	07:37	07:41	08:36
	16:09	17:10	18:10	20:12	21:12	22:01	22:02	21:12	19:57	18:39	16:28	15:50
10	08:46	07:58	06:52	06:32	05:22	04:39	04:50	05:41	06:41	07:39	07:43	08:37
	16:11	17:13	18:12	20:14	21:14	22:02	22:01	21:10	19:54	18:36	16:26	15:49
11	08:45	07:56	06:49	06:29	05:20	04:39	04:51	05:43	06:43	07:41	07:45	08:38
	16:12	17:15	18:14	20:16	21:16	22:02	22:00	21:08	19:52	18:34	16:24	15:49
12	08:44	07:54	06:47	06:27	05:18	04:38	04:53	05:45	06:45	07:43	07:47	08:39
	16:14	17:17	18:16	20:18	21:18	22:03	21:59	21:06	19:49	18:31	16:22	15:49
13	08:43	07:52	06:44	06:24	05:16	04:38	04:54	05:47	06:47	07:45	07:49	08:40
	16:16	17:19	18:18	20:20	21:20	22:04	21:58	21:03	19:46	18:29	16:20	15:48
14	08:42	07:50	06:42	06:22	05:14	04:37	04:55	05:49	06:49	07:47	07:51	08:41
	16:18	17:21	18:20	20:23	21:22	22:05	21:57	21:01	19:44	18:26	16:18	15:48
15	08:41	07:48	06:39	06:19	05:12	04:37	04:57	05:51	06:50	07:49	07:53	08:43
	16:19	17:23	18:22	20:25	21:23	22:05	21:56	20:59	19:41	18:24	16:17	15:48
16	08:40	07:45	06:37	06:17	05:10	04:37	04:58	05:53	06:52	07:51	07:55	08:43
	16:21	17:26	18:24	20:27	21:25	22:06	21:55	20:57	19:39	18:21	16:15	15:48
17	08:39	07:43	06:34	06:14	05:09	04:37	04:59	05:55	06:54	07:53	07:57	08:44
	16:23	17:28	18:26	20:29	21:27	22:07	21:53	20:54	19:36	18:19	16:13	15:48
18	08:38	07:41	06:31	06:12	05:07	04:37	05:01	05:57	06:56	07:55	07:59	08:45
	16:25	17:30	18:28	20:31	21:29	22:07	21:52	20:52	19:33	18:16	16:12	15:49
19	08:36	07:38	06:29	06:09	05:05	04:37	05:03	05:59	06:58	07:57	08:01	08:46
	16:27	17:32	18:30	20:33	21:31	22:08	21:51	20:49	19:31	18:14	16:10	15:49
20	08:35	07:36	06:26	06:07	05:03	04:37	05:04	06:01	07:00	07:59	08:03	08:47
	16:29	17:34	18:32	20:35	21:32	22:08	21:49	20:47	19:28	18:11	16:09	15:49
21	08:34	07:34	06:24	06:04	05:02	04:37	05:06	06:02	07:02	08:01	08:05	08:47
	16:31	17:36	18:34	20:37	21:34	22:08	21:48	20:45	19:25	18:09	16:07	15:50
22	08:32	07:31	06:21	06:02	05:00	04:37	05:07	06:04	07:04	08:03	08:07	08:48
	16:33	17:39	18:36	20:39	21:36	22:08	21:46	20:42	19:23	18:07	16:06	15:50
23	08:31	07:29	06:18	06:00	04:59	04:37	05:09	06:06	07:06	08:05	08:09	08:48
	16:35	17:41	18:38	20:41	21:38	22:09	21:45	20:40	19:20	18:04	16:04	15:50
24	08:30	07:27	06:16	05:57	04:57	04:37	05:11	06:08	07:08	08:07	08:11	08:49
	16:37	17:43	18:40	20:43	21:39	22:09	21:43	20:37	19:18	18:02	16:03	15:51
25	08:28	07:24	06:13	05:55	04:56	04:38	05:12	06:10	07:10	08:10	08:13	08:49
	16:39	17:45	18:42	20:45	21:41	22:09	21:41	20:35	19:15	18:00	16:02	15:52
26	08:26	07:22	06:11	05:53	04:54	04:38	05:14	06:12	07:12	08:12	08:15	08:49
	16:41	17:47	18:44	20:47	21:42	22:09	21:40	20:32	19:12	17:57	16:00	15:52
27	08:25	07:19	06:08	05:50	04:53	04:39	05:16	06:14	07:14	08:14	08:17	08:50
	16:43	17:49	18:46	20:49	21:44	22:08	21:38	20:30	19:10	17:55	15:59	15:53
28	08:23	07:17	07:05	05:48	04:51	04:39	05:17	06:16	07:15	08:16	08:18	08:50
	16:45	17:51	19:48	20:51	21:46	22:08	21:36	20:27	19:07	17:53	15:58	15:54
29	08:21		07:03	05:46	04:50	04:40	05:19	06:18	07:17	08:18	08:20	08:50
	16:47		19:50	20:53	21:47	22:08	21:34	20:25	19:04	17:51	15:57	15:55
30	08:20		07:00	05:43	04:49	04:40	05:21	06:20	07:19	08:20	08:22	08:50
	16:49		19:52	20:55	21:48	22:08	21:32	20:22	19:02	17:48	15:56	15:56
31	08:18		06:58		04:48		05:23	06:22		07:22		08:50
	16:51		19:54		21:50		21:31	20:20		16:46		15:57
Potential sun hours	240	268	366	424	503	522	524	466	384	326	252	222
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Clachaig_Glen_210805

Licensed user:
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GB-NEWCASTLE upon Tyne NE1 2HF
+44 191 224 6610
Laura Craggs / laura.craggs@aecom.com

Calculated:
05/08/2021 17:52/3.0.651

SHADOW - Calendar per WTG

Calculation: SF ES Layout 210805WTG: 10 - Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 122.5 m (TOT: 200.0 m) (61)

Assumptions for shadow calculations

Reference year for calendar 2021

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:50	08:16	07:15	06:55	05:41	04:47 05:56-06:09/13	04:41	05:25 06:01-06:21/20	06:24	07:21	07:24	08:23
	15:58	16:53	17:53	19:56	20:56	21:51	22:07	21:29	20:17	18:59	16:44	15:55
2	08:50	08:14	07:12	06:52	05:39	04:46 05:57-06:08/11	04:42	05:26 06:02-06:21/19	06:26	07:23	07:26	08:25
	16:00	16:55	17:55	19:58	20:58	21:53	22:07	21:27	20:15	18:57	16:42	15:54
3	08:49	08:12	07:10	06:50	05:37	04:45 05:58-06:07/9	04:43	05:28 06:04-06:20/16	06:27	07:25	07:28	08:27
	16:01	16:57	17:57	20:00	21:00	21:54	22:06	21:25	20:12	18:54	16:40	15:53
4	08:49	08:10	07:07	06:47	05:34	04:44 06:00-06:06/6	04:44	05:30 06:04-06:18/14	06:29	07:27	07:30	08:28
	16:02	17:00	18:00	20:02	21:02	21:55	22:06	21:23	20:10	18:51	16:38	15:53
5	08:49	08:09	07:05	06:45	05:32	04:43	04:45	05:32 06:07-06:16/9	06:31	07:29	07:33	08:30
	16:03	17:02	18:02	20:04	21:04	21:56	22:05	21:21	20:07	18:49	16:36	15:52
6	08:48	08:07	07:02	06:42	05:30	04:42	04:46	05:34	06:33	07:31	07:35	08:31
	16:05	17:04	18:04	20:06	21:06	21:57	22:05	21:19	20:05	18:46	16:33	15:51
7	08:48	08:05	07:00	06:39	05:28	04:41	04:47	05:36	06:35	07:33	07:37	08:33
	16:06	17:06	18:06	20:08	21:08	21:59	22:04	21:16	20:02	18:44	16:31	15:51
8	08:47	08:03	06:57	06:37	05:26 05:57-06:05/8	04:40	04:48	05:38	06:37	07:35	07:39	08:34
	16:08	17:08	18:08	20:10	21:10	22:00	22:03	21:14	19:59	18:41	16:29	15:50
9	08:46	08:00	06:54	06:34	05:24 05:55-06:08/13	04:40	04:49 06:07-06:13/6	05:39	06:39	07:37	07:41	08:36
	16:09	17:10	18:10	20:12	21:12	22:01	22:02	21:12	19:57	18:39	16:28	15:50
10	08:46	07:58	06:52	06:32	05:22 05:54-06:09/15	04:39	04:50 06:06-06:15/9	05:41	06:41	07:39	07:43	08:37
	16:11	17:13	18:12	20:14	21:14	22:02	22:01	21:10	19:54	18:36	16:26	15:49
11	08:45	07:56	06:49	06:29	05:20 05:52-06:10/18	04:39	04:51 06:05-06:16/11	05:43	06:43	07:41	07:45	08:38
	16:12	17:15	18:14	20:16	21:16	22:02	22:00	21:08	19:52	18:34	16:24	15:49
12	08:44	07:54	06:47	06:27	05:18 05:51-06:11/20	04:38	04:53 06:04-06:17/13	05:45	06:45	07:43	07:47	08:39
	16:14	17:17	18:16	20:18	21:18	22:03	21:59	21:06	19:49	18:31	16:22	15:49
13	08:43	07:52	06:44	06:24	05:16 05:50-06:11/21	04:38	04:54 06:03-06:18/15	05:47	06:47	07:45	07:49	08:40
	16:16	17:19	18:18	20:20	21:20	22:04	21:58	21:03	19:46	18:29	16:20	15:48
14	08:42	07:50	06:42	06:22	05:14 05:50-06:12/22	04:37	04:55 06:02-06:18/16	05:49	06:49	07:47	07:51	08:41
	16:18	17:21	18:20	20:22	21:22	22:05	21:57	21:01	19:44	18:26	16:18	15:48
15	08:41	07:48	06:39	06:19	05:12 05:50-06:13/23	04:37	04:57 06:02-06:20/18	05:51	06:50	07:49	07:53	08:42
	16:19	17:23	18:22	20:24	21:23	22:05	21:56	20:59	19:41	18:24	16:17	15:48
16	08:40	07:45	06:36	06:17	05:10 05:49-06:12/23	04:37	04:58 06:01-06:20/19	05:53	06:52	07:51	07:55	08:43
	16:21	17:26	18:24	20:26	21:25	22:06	21:55	20:56	19:39	18:21	16:15	15:48
17	08:39	07:43	06:34	06:14	05:09 05:49-06:13/24	04:37	04:59 06:01-06:21/20	05:55	06:54	07:53	07:57	08:44
	16:23	17:28	18:26	20:28	21:27	22:07	21:53	20:54	19:36	18:19	16:13	15:48
18	08:38	07:41	06:31	06:12	05:07 05:49-06:13/24	04:37	05:01 06:01-06:22/21	05:57	06:56	07:55	07:59	08:45
	16:25	17:30	18:28	20:30	21:29	22:07	21:52	20:52	19:33	18:16	16:12	15:49
19	08:36	07:38	06:29	06:09	05:05 05:49-06:14/25	04:37	05:02 06:00-06:22/22	05:59	06:58	07:57	08:01	08:46
	16:27	17:32	18:30	20:33	21:31	22:07	21:51	20:49	19:31	18:14	16:10	15:49
20	08:35	07:36	06:26	06:07	05:03 05:49-06:13/24	04:37	05:04 06:01-06:23/22	06:01	07:00	07:59	08:03	08:47
	16:29	17:34	18:32	20:35	21:32	22:08	21:49	20:47	19:28	18:11	16:09	15:49
21	08:34	07:34	06:24	06:04	05:02 05:50-06:13/23	04:37	05:06 06:00-06:23/23	06:02	07:02	08:01	08:05	08:47
	16:31	17:36	18:34	20:37	21:34	22:08	21:48	20:45	19:25	18:09	16:07	15:49
22	08:32	07:31	06:21	06:02	05:00 05:49-06:13/24	04:37	05:07 05:59-06:23/24	06:04	07:04	08:03	08:07	08:48
	16:33	17:38	18:36	20:39	21:36	22:08	21:46	20:42	19:23	18:07	16:06	15:50
23	08:31	07:29	06:18	06:00	04:59 05:50-06:13/23	04:37	05:09 06:00-06:23/23	06:06	07:06	08:05	08:09	08:48
	16:35	17:41	18:38	20:41	21:38	22:08	21:45	20:40	19:20	18:04	16:04	15:50
24	08:30	07:27	06:16	05:57	04:57 05:51-06:13/22	04:37	05:11 06:00-06:24/24	06:08	07:08	08:07	08:11	08:49
	16:37	17:43	18:40	20:43	21:39	22:09	21:43	20:37	19:18	18:02	16:03	15:51
25	08:28	07:24	06:13	05:55	04:56 05:51-06:13/22	04:38	05:12 06:00-06:24/24	06:10	07:10	08:10	08:13	08:49
	16:39	17:45	18:42	20:45	21:41	22:09	21:41	20:35	19:15	18:00	16:02	15:52
26	08:26	07:22	06:10	05:52	04:54 05:51-06:12/21	04:38	05:14 06:00-06:24/24	06:12	07:12	08:12	08:15	08:49
	16:41	17:47	18:44	20:47	21:42	22:09	21:40	20:32	19:12	17:57	16:00	15:52
27	08:25	07:19	06:08	05:50	04:53 05:52-06:12/20	04:39	05:16 06:00-06:23/23	06:14	07:14	08:14	08:17	08:50
	16:43	17:49	18:46	20:49	21:44	22:08	21:38	20:30	19:10	17:55	15:59	15:53
28	08:23	07:17	07:05	05:48	04:51 05:52-06:11/19	04:39	05:17 06:00-06:24/24	06:16	07:15	08:16	08:18	08:50
	16:45	17:51	19:48	20:51	21:45	22:08	21:36	20:27	19:07	17:53	15:58	15:54
29	08:21		07:03	05:46	04:50 05:53-06:11/18	04:40	05:19 06:00-06:23/23	06:18	07:17	08:18	08:20	08:50
	16:47		19:50	20:52	21:47	22:08	21:34	20:25	19:04	17:51	15:57	15:55
30	08:20		07:00	05:43	04:49 05:54-06:10/16	04:40	05:21 06:01-06:23/22	06:20	07:19	08:20	08:22	08:50
	16:49		19:52	20:54	21:48	22:08	21:32	20:22	19:02	17:48	15:56	15:56
31	08:18		06:57		04:48 05:55-06:10/15		05:23 06:01-06:22/21	06:22		07:22		08:50
	16:51		19:54		21:50		21:31	20:20		16:46		15:57
Potential sun hours	240	268	366	424	503	522	523	466	384	326	252	222
Sum of minutes with flicker	0	0	0	0	483	39	447	78	0	0	0	0

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

Clachaig_Glen_210805

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Laura Craggs / laura.craggs@aecom.com

Calculated:
05/08/2021 17:52/3.0.651

SHADOW - Calendar per WTG

Calculation: SF ES Layout 210805WTG: 11 - Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 122.5 m (TOT: 200.0 m) (62)

Assumptions for shadow calculations

Reference year for calendar 2021

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:50	08:16	07:14	06:55	05:41	04:47	04:41	05:24	06:24	07:21	07:24	08:23
	15:58	16:53	17:53	19:56	20:56	21:51	22:07	21:29	20:17	18:59	16:44	15:55
2	08:50	08:14	07:12	06:52	05:39	04:46	04:42	05:26	06:25	07:23	07:26	08:25
	15:59	16:55	17:55	19:58	20:58	21:52	22:07	21:27	20:15	18:57	16:42	15:54
3	08:49	08:12	07:10	06:50	05:37	04:45	04:43	05:28	06:27	07:25	07:28	08:27
	16:01	16:57	17:57	20:00	21:00	21:54	22:06	21:25	20:12	18:54	16:40	15:53
4	08:49	08:10	07:07	06:47	05:34	04:44	04:44	05:30	06:29	07:27	07:30	08:28
	16:02	17:00	18:00	20:02	21:02	21:55	22:06	21:23	20:10	18:51	16:38	15:52
5	08:49	08:08	07:05	06:44	05:32	04:43	04:45	05:32	06:31	07:29	07:32	08:30
	16:03	17:02	18:02	20:04	21:04	21:56	22:05	21:21	20:07	18:49	16:35	15:52
6	08:48	08:07	07:02	06:42	05:30	04:42	04:46	05:34	06:33	07:31	07:35	08:31
	16:05	17:04	18:04	20:06	21:06	21:57	22:05	21:19	20:05	18:46	16:33	15:51
7	08:48	08:05	06:59	06:39	05:28	04:41	04:47	05:36	06:35	07:33	07:37	08:33
	16:06	17:06	18:06	20:08	21:08	21:58	22:04	21:16	20:02	18:44	16:31	15:51
8	08:47	08:02	06:57	06:37	05:26	04:40	04:48	05:38	06:37	07:35	07:39	08:34
	16:08	17:08	18:08	20:10	21:10	22:00	22:03	21:14	19:59	18:41	16:29	15:50
9	08:46	08:00	06:54	06:34	05:24	04:40	04:49	05:39	06:39	07:37	07:41	08:35
	16:09	17:10	18:10	20:12	21:12	22:01	22:02	21:12	19:57	18:39	16:27	15:50
10	08:46	07:58	06:52	06:32	05:22	04:39	04:50	05:41	06:41	07:39	07:43	08:37
	16:11	17:13	18:12	20:14	21:14	22:01	22:01	21:10	19:54	18:36	16:26	15:49
11	08:45	07:56	06:49	06:29	05:20	04:39	04:51	05:43	06:43	07:41	07:45	08:38
	16:12	17:15	18:14	20:16	21:16	22:02	22:00	21:08	19:52	18:34	16:24	15:49
12	08:44	07:54	06:47	06:27	05:18	04:38	04:52	05:45	06:45	07:43	07:47	08:39
	16:14	17:17	18:16	20:18	21:18	22:03	21:59	21:06	19:49	18:31	16:22	15:49
13	08:43	07:52	06:44	06:24	05:16	04:38	04:54	05:47	06:47	07:45	07:49	08:40
	16:16	17:19	18:18	20:20	21:20	22:04	21:58	21:03	19:46	18:29	16:20	15:48
14	08:42	07:50	06:42	06:22	05:14	04:37	04:55	05:49	06:49	07:47	07:51	08:41
	16:17	17:21	18:20	20:22	21:22	22:05	21:57	21:01	19:44	18:26	16:18	15:48
15	08:41	07:47	06:39	06:19	05:12	04:37	04:57	05:51	06:50	07:49	07:53	08:42
	16:19	17:23	18:22	20:24	21:23	22:05	21:56	20:59	19:41	18:24	16:17	15:48
16	08:40	07:45	06:36	06:17	05:10	04:37	04:58	05:53	06:52	07:51	07:55	08:43
	16:21	17:26	18:24	20:26	21:25	22:06	21:55	20:56	19:38	18:21	16:15	15:48
17	08:39	07:43	06:34	06:14	05:08	04:37	04:59	05:55	06:54	07:53	07:57	08:44
	16:23	17:28	18:26	20:28	21:27	22:07	21:53	20:54	19:36	18:19	16:13	15:48
18	08:38	07:41	06:31	06:12	05:07	04:37	05:01	05:57	06:56	07:55	07:59	08:45
	16:25	17:30	18:28	20:30	21:29	22:07	21:52	20:52	19:33	18:16	16:12	15:49
19	08:36	07:38	06:29	06:09	05:05	04:37	05:02	05:59	06:58	07:57	08:01	08:46
	16:27	17:32	18:30	20:32	21:31	22:07	21:51	20:49	19:31	18:14	16:10	15:49
20	08:35	07:36	06:26	06:07	05:03	04:37	05:04	06:00	07:00	07:59	08:03	08:47
	16:29	17:34	18:32	20:34	21:32	22:08	21:49	20:47	19:28	18:11	16:08	15:49
21	08:34	07:34	06:23	06:04	05:02	04:37	05:06	06:02	07:02	08:01	08:05	08:47
	16:31	17:36	18:34	20:36	21:34	22:08	21:48	20:45	19:25	18:09	16:07	15:49
22	08:32	07:31	06:21	06:02	05:00	04:37	05:07	06:04	07:04	08:03	08:07	08:48
	16:32	17:38	18:36	20:38	21:36	22:08	21:46	20:42	19:23	18:07	16:06	15:50
23	08:31	07:29	06:18	06:00	04:59	04:37	05:09	06:06	07:06	08:05	08:09	08:48
	16:34	17:41	18:38	20:40	21:37	22:08	21:45	20:40	19:20	18:04	16:04	15:50
24	08:29	07:27	06:16	05:57	04:57	04:37	05:10	06:08	07:08	08:07	08:11	08:49
	16:37	17:43	18:40	20:42	21:39	22:09	21:43	20:37	19:17	18:02	16:03	15:51
25	08:28	07:24	06:13	05:55	04:56	04:38	05:12	06:10	07:10	08:09	08:13	08:49
	16:39	17:45	18:42	20:44	21:41	22:09	21:41	20:35	19:15	18:00	16:02	15:52
26	08:26	07:22	06:10	05:52	04:54	04:38	05:14	06:12	07:12	08:12	08:15	08:49
	16:41	17:47	18:44	20:46	21:42	22:09	21:40	20:32	19:12	17:57	16:00	15:52
27	08:25	07:19	06:08	05:50	04:53	04:39	05:16	06:14	07:13	08:14	08:16	08:50
	16:43	17:49	18:46	20:48	21:44	22:08	21:38	20:30	19:10	17:55	15:59	15:53
28	08:23	07:17	07:05	05:48	04:51	04:39	05:17	06:16	07:15	08:16	08:18	08:50
	16:45	17:51	19:48	20:50	21:45	22:08	21:36	20:27	19:07	17:53	15:58	15:54
29	08:21		07:03	05:45	04:50	04:40	05:19	06:18	07:17	08:18	08:20	08:50
	16:47		19:50	20:52	21:47	22:08	21:34	20:25	19:04	17:50	15:57	15:55
30	08:20		07:00	05:43	04:49	04:40	05:21	06:20	07:19	08:20	08:22	08:50
	16:49		19:52	20:54	21:48	22:08	21:32	20:22	19:02	17:48	15:56	15:56
31	08:18		06:57		04:48		05:23	06:22		07:22		08:50
	16:51		19:54		21:50		21:30	20:20		16:46		15:57
Potential sun hours	240	268	366	424	503	522	523	466	384	326	252	222
Sum of minutes with flicker	0	0	0	0	0	0	0	0	0	0	0	0

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

Project:

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Laura Craggs / laura.craggs@aecom.com

Calculated:
05/08/2021 17:52/3.0.651

SHADOW - Calendar per WTG

Calculation: SF ES Layout 210805WTG: 12 - Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 122.5 m (TOT: 200.0 m) (63)

Assumptions for shadow calculations

Reference year for calendar 2021

The calculated times are "worst case" given by the following assumptions:

The sun is shining all the day, from sunrise to sunset

The rotor plane is always perpendicular to the line from the WTG to the sun

The WTG is always operating

	January	February	March	April	May	June	July	August	September	October	November	December
1	08:50	08:16	07:15	06:55	05:41 06:20-06:41/21	04:47	04:41	05:25 06:24-06:55/31	06:24	07:21	07:24	08:23
	15:58	16:53	17:53	19:56	20:56	21:51	22:07	21:29	20:17	18:59	16:44	15:55
2	08:50	08:14	07:12	06:52	05:39 06:18-06:42/24	04:46	04:42	05:26 06:24-06:56/32	06:26	07:23	07:26	08:25
	16:00	16:55	17:55	19:58	20:58	21:53	22:07	21:27	20:15	18:57	16:42	15:54
3	08:49	08:12	07:10	06:50	05:37 06:17-06:43/26	04:45	04:43	05:28 06:24-06:56/32	06:27	07:25	07:28	08:27
	16:01	16:58	17:58	20:00	21:00	21:54	22:06	21:25	20:12	18:54	16:40	15:53
4	08:49	08:10	07:07	06:47	05:34 06:16-06:44/28	04:44	04:44	05:30 06:24-06:55/31	06:29	07:27	07:30	08:28
	16:02	17:00	18:00	20:02	21:02	21:55	22:06	21:23	20:10	18:52	16:38	15:53
5	08:49	08:09	07:05	06:45	05:32 06:16-06:44/28	04:43	04:45	05:32 06:24-06:55/31	06:31	07:29	07:33	08:30
	16:03	17:02	18:02	20:04	21:04	21:56	22:05	21:21	20:07	18:49	16:36	15:52
6	08:48	08:07	07:02	06:42	05:30 06:15-06:44/29	04:42	04:46	05:34 06:25-06:55/30	06:33	07:31	07:35	08:31
	16:05	17:04	18:04	20:06	21:06	21:57	22:05	21:19	20:05	18:46	16:34	15:51
7	08:48	08:05	07:00	06:39	05:28 06:14-06:45/31	04:41	04:47	05:36 06:25-06:55/30	06:35	07:33	07:37	08:33
	16:06	17:06	18:06	20:08	21:08	21:59	22:04	21:16	20:02	18:44	16:31	15:51
8	08:47	08:03	06:57	06:37	05:26 06:14-06:45/31	04:40	04:48	05:38 06:25-06:54/29	06:37	07:35	07:39	08:34
	16:08	17:08	18:08	20:10	21:10	22:00	22:03	21:14	19:59	18:41	16:30	15:50
9	08:46	08:00	06:54	06:34	05:24 06:15-06:46/31	04:40	04:49	05:39 06:26-06:53/27	06:39	07:37	07:41	08:36
	16:09	17:10	18:10	20:12	21:12	22:01	22:02	21:12	19:57	18:39	16:28	15:50
10	08:46	07:58	06:52	06:32	05:22 06:14-06:46/32	04:39	04:50	05:41 06:26-06:52/26	06:41	07:39	07:43	08:37
	16:11	17:13	18:12	20:14	21:14	22:02	22:01	21:10	19:54	18:36	16:26	15:49
11	08:45	07:56	06:49	06:29	05:20 06:14-06:46/32	04:39	04:51	05:43 06:27-06:52/25	06:43	07:41	07:45	08:38
	16:12	17:15	18:14	20:16	21:16	22:02	22:00	21:08	19:52	18:34	16:24	15:49
12	08:44	07:54	06:47	06:27	05:18 06:14-06:45/31	04:38	04:53	05:45 06:28-06:49/21	06:45	07:43	07:47	08:39
	16:14	17:17	18:16	20:18	21:18	22:03	21:59	21:06	19:49	18:31	16:22	15:49
13	08:43	07:52	06:44	06:24	05:16 06:14-06:45/31	04:38	04:54	05:47 06:29-06:48/19	06:47	07:45	07:49	08:40
	16:16	17:19	18:18	20:20	21:20	22:04	21:58	21:03	19:46	18:29	16:20	15:49
14	08:42	07:50	06:42	06:22	05:14 06:14-06:45/31	04:37	04:55	05:49 06:31-06:46/15	06:49	07:47	07:51	08:41
	16:18	17:21	18:20	20:22	21:22	22:05	21:57	21:01	19:44	18:26	16:18	15:48
15	08:41	07:48	06:39	06:19	05:12 06:14-06:45/31	04:37	04:57	05:51 06:34-06:43/9	06:50	07:49	07:53	08:42
	16:19	17:23	18:22	20:24	21:23	22:05	21:56	20:59	19:41	18:24	16:17	15:48
16	08:40	07:45	06:36	06:17	05:10 06:14-06:44/30	04:37	04:58 06:36-06:42/6	05:53	06:52	07:51	07:55	08:43
	16:21	17:26	18:24	20:26	21:25	22:06	21:55	20:56	19:39	18:21	16:15	15:48
17	08:39	07:43	06:34	06:14	05:09 06:15-06:44/29	04:37	04:59 06:33-06:44/11	05:55	06:54	07:53	07:57	08:44
	16:23	17:28	18:26	20:28	21:27	22:07	21:53	20:54	19:36	18:19	16:13	15:48
18	08:38	07:41	06:31	06:12	05:07 06:15-06:43/28	04:37	05:01 06:32-06:47/15	05:57	06:56	07:55	07:59	08:45
	16:25	17:30	18:28	20:31	21:29	22:07	21:52	20:52	19:33	18:16	16:12	15:49
19	08:36	07:38	06:29	06:09	05:05 06:16-06:43/27	04:37	05:03 06:31-06:48/17	05:59	06:58	07:57	08:01	08:46
	16:27	17:32	18:30	20:33	21:31	22:07	21:51	20:49	19:31	18:14	16:10	15:49
20	08:35	07:36	06:26	06:07	05:03 06:17-06:42/25	04:37	05:04 06:30-06:50/20	06:01	07:00	07:59	08:03	08:47
	16:29	17:34	18:32	20:35	21:32	22:08	21:49	20:47	19:28	18:11	16:09	15:49
21	08:34	07:34	06:24	06:04	05:02 06:18-06:42/24	04:37	05:06 06:29-06:50/21	06:02	07:02	08:01	08:05	08:47
	16:31	17:36	18:34	20:37	21:34	22:08	21:48	20:45	19:25	18:09	16:07	15:50
22	08:32	07:31	06:21	06:02	05:00 06:18-06:41/23	04:37	05:07 06:28-06:51/23	06:04	07:04	08:03	08:07	08:48
	16:33	17:39	18:36	20:39	21:36	22:08	21:46	20:42	19:23	18:07	16:06	15:50
23	08:31	07:29	06:18	06:00	04:59 06:19-06:40/21	04:37	05:09 06:28-06:52/24	06:06	07:06	08:05	08:09	08:48
	16:35	17:41	18:38	20:41	21:38	22:08	21:45	20:40	19:20	18:04	16:04	15:50
24	08:30	07:27	06:16	05:57	04:57 06:20-06:40/20	04:37	05:11 06:28-06:53/25	06:08	07:08	08:07	08:11	08:49
	16:37	17:43	18:40	20:43	21:39	22:09	21:43	20:37	19:18	18:02	16:03	15:51
25	08:28	07:24	06:13	05:55	04:56 06:22-06:39/17	04:38	05:12 06:27-06:53/26	06:10	07:10	08:10	08:13	08:49
	16:39	17:45	18:42	20:45	21:41	22:09	21:41	20:35	19:15	18:00	16:02	15:52
26	08:26	07:22	06:11	05:52	04:54 06:22-06:37/15	04:38	05:14 06:26-06:54/28	06:12	07:12	08:12	08:15	08:49
	16:41	17:47	18:44	20:47	21:42	22:09	21:40	20:32	19:12	17:57	16:00	15:52
27	08:25	07:19	06:08	05:50	04:53 06:24-06:35/11	04:39	05:16 06:25-06:54/29	06:14	07:14	08:14	08:17	08:50
	16:43	17:49	18:46	20:49	21:44	22:08	21:38	20:30	19:10	17:55	15:59	15:53
28	08:23	07:17	07:05	05:48 06:28-06:34/6	04:51 06:27-06:33/6	04:39	05:17 06:25-06:55/30	06:16	07:15	08:16	08:18	08:50
	16:45	17:51	19:48	20:51	21:45	22:08	21:36	20:27	19:07	17:53	15:58	15:54
29	08:21		07:03	05:46 06:24-06:38/14	04:50	04:40	05:19 06:25-06:55/30	06:18	07:17	08:18	08:20	08:50
	16:47		19:50	20:53	21:47	22:08	21:34	20:25	19:04	17:51	15:57	15:55
30	08:20		07:00	05:43 06:22-06:40/18	04:49	04:40	05:21 06:25-06:55/30	06:20	07:19	08:20	08:22	08:50
	16:49		19:52	20:54	21:48	22:08	21:32	20:22	19:02	17:48	15:56	15:56
31	08:18		06:57		04:48		05:23 06:25-06:56/31	06:22		07:22		08:50
	16:51		19:54		21:50		21:31	20:20		16:46		15:57
Potential sun hours	240	268	366	424	503	522	523	466	384	326	252	222
Sum of minutes with flicker	0	0	0	38	713	0	366	388	0	0	0	0

Table layout: For each day in each month the following matrix apply

Day in month	Sun rise (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker
	Sun set (hh:mm)	First time (hh:mm) with flicker-Last time (hh:mm) with flicker/Minutes with flicker

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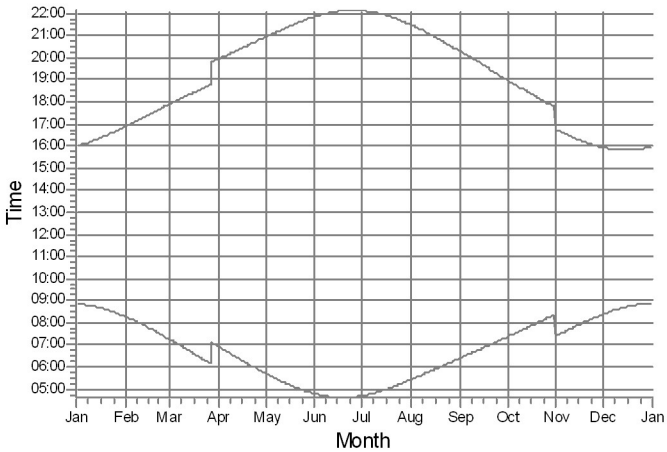
Laura Craggs / laura.craggs@aecom.com

Calculated:
05/08/2021 17:52/3.0.651

SHADOW - Calendar per WTG, graphical

Calculation: SF ES Layout 210805

Siemens Gamesa SG 6.0-155 6600 155.0 !O! hub: 107.5 m (TOT: 185.0 m) (



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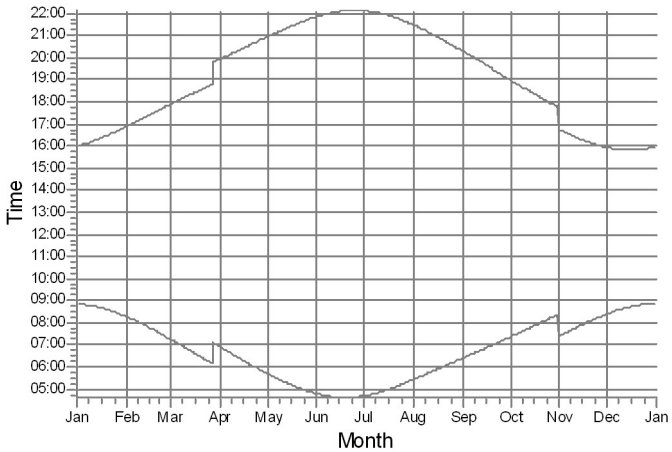

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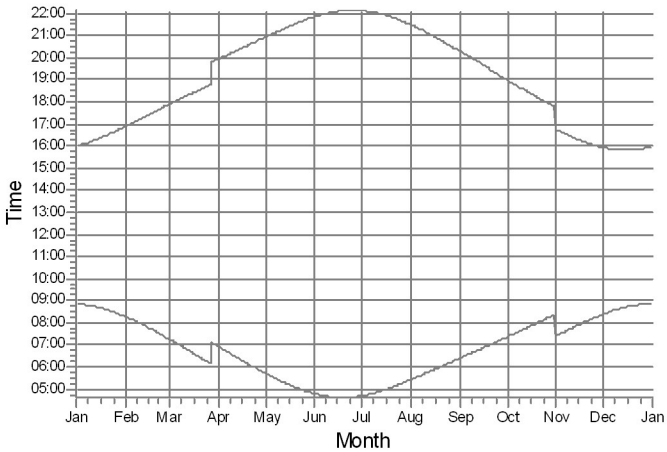

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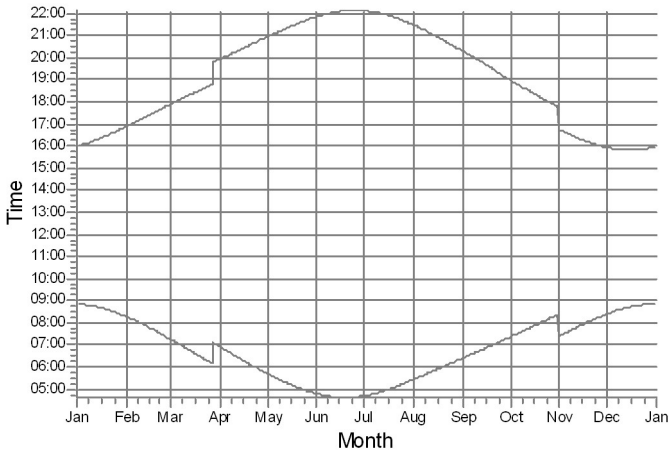

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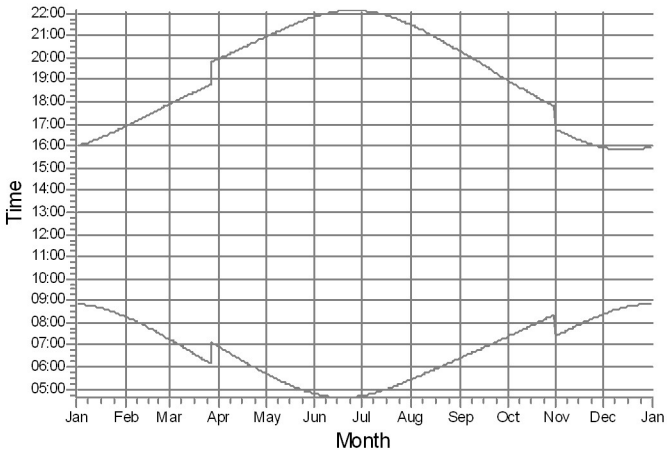

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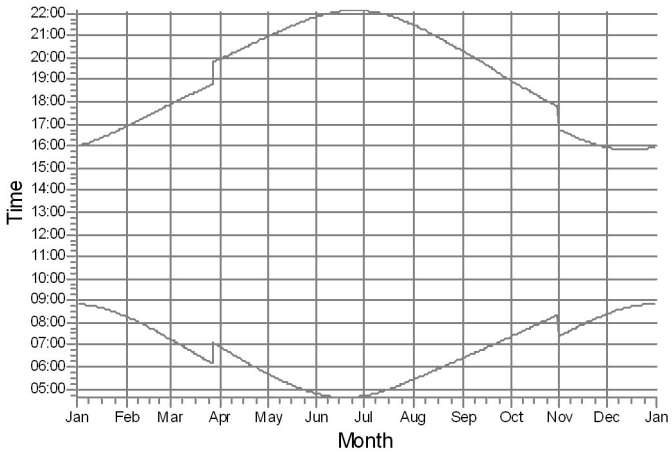

Shadow receptors

Project:
Clachaig_Glen_210805

Licensed user:
AECOM Professional Services LLP Limited
First Floor, One Trinity Gardens, Quayside
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Calculated:
05/08/2021 17:52/3.0.651

SHADOW - Calendar per WTG, graphical

Calculation: SF ES Layout 210805

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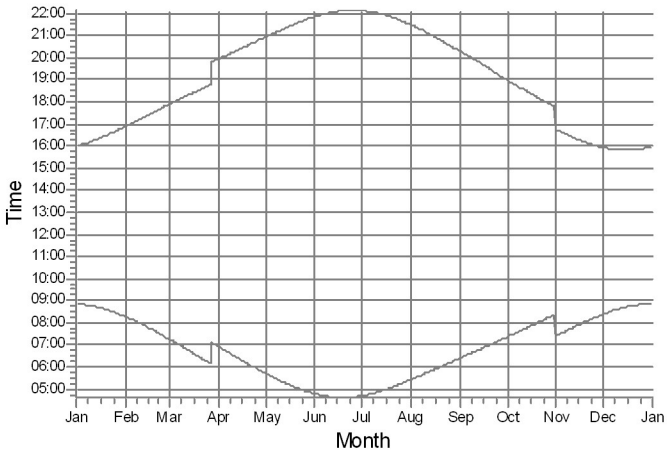

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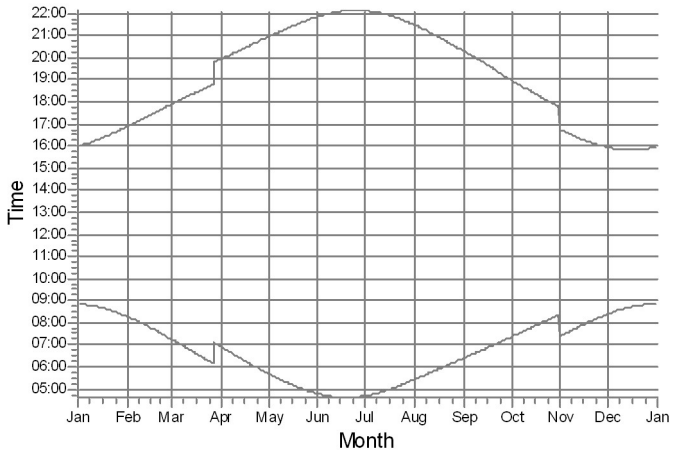

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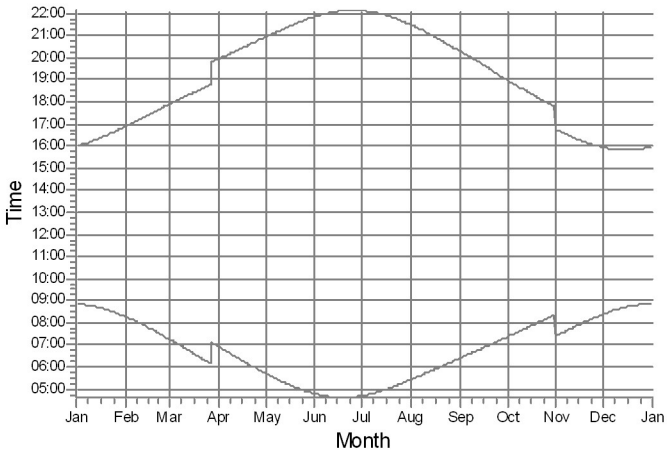

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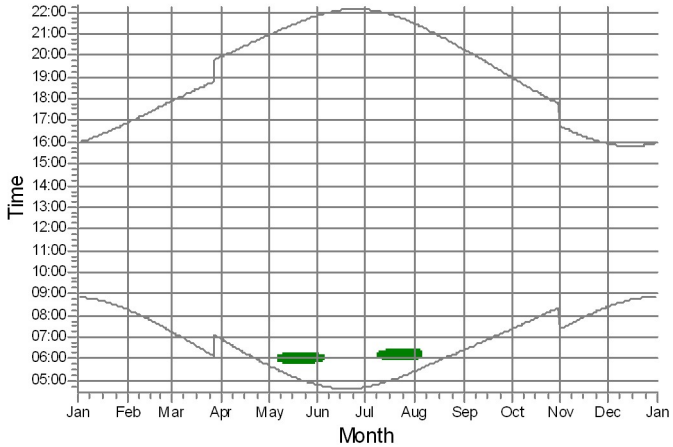

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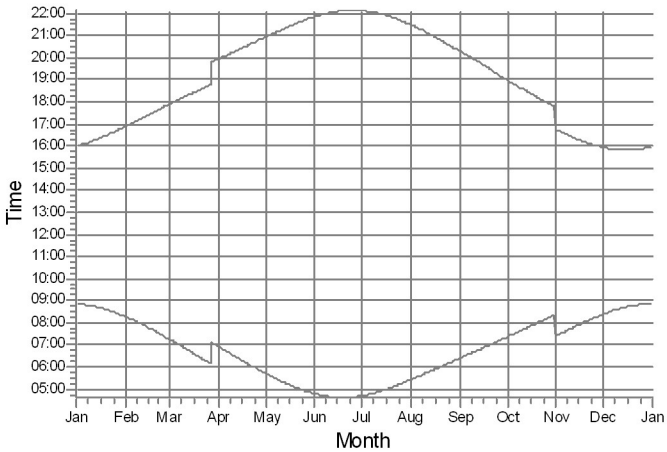

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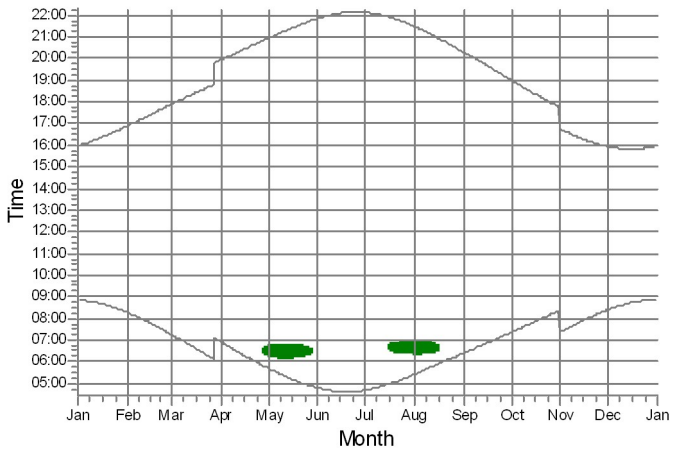

Shadow receptors

🟩 A: Shadow Receptor: 1.0 × 1.0 Azimuth: -180.0° Slope: 90.0° (16)

RWE

Clachaig Glen Wind Farm

Environmental Impact Assessment Report

Volume 3

Technical Appendices

Appendix 19.1: Schedule of Mitigation

Appendix 19.1 Schedule of Mitigation

19.1.1 The Schedule of Mitigation presented in this Appendix presents all of the additional mitigation, monitoring and enhancement measures (i.e. those not embedded in the design of the Proposed Development) which are set out in the technical chapters (7 to 18) of the Environmental Impact Assessment Report (EIAR Volume 2a).

Table 19.1 Schedule of Mitigation

Chapter	Chapter Title	Mitigation
7	Landscape and Visual	None (all embedded).
8	Noise	Good industry practice construction methods shall be employed at all times, having regards to the principles of Best Practicable Means (BPM) to minimise noise and vibration impacts during the construction of the Proposed Development. British Standard BS 5228:2009+A1:2014 provides detailed advice on methods for minimising impacts from construction noise. This includes the following: • Adherence to the codes of practice for construction working and piling in BS 5228:2009+A1:2014 for minimising noise emissions from the Development Site, • Proper use of plant and regular maintenance. All vehicles and mechanical plant used for the construction works will be maintained in good efficient working order, • Selection of inherently quiet plant, where appropriate and possible. All major compressors should be ‘sound-reduced’ models fitted with properly lined and sealed acoustic covers which would be kept closed whenever the machines are in use and all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers, • Machines in intermittent use will be shut down during periods of inactivity or throttled down to a minimum, • All ancillary plant such as generators, compressors and pumps to be positioned so as to cause minimum noise disturbance. If necessary, acoustic barriers or enclosures will be provided,

Chapter	Chapter Title	Mitigation
		• Unless dangerous or more environmentally damaging, piling should not take place before 08.00 or after 18.00 Monday to Friday and on Saturdays should not take place before 09.00 and after 13.00. Piling should not take place on Sundays or Bank Holidays or during the night-time period, • Use of modern plant, complying with the latest European Commission (EC) noise emission requirements (Directive 2000/14/EC), • Arrange the Development Site operations and vehicle routes to minimise the need for reversing movements (and the associated reversing alarms), including signage reminding staff on site at intermittent locations. The Development Site layout incorporates a loop to minimise the need for reversing, • No employees, subcontractors and persons employed on the Development Site to cause unnecessary noise from their activities (such as, excessive 'revving' of vehicle engines, music from radios and shouting, etc.), • The proposed core hours of construction activities are 07:00 to 19:00 hours Monday to Friday, 09:00 to 17:00 Saturday, with no working on Sunday or Bank Holidays. In the event that construction activities cannot be avoided outside of these hours, such as during concrete pours or delivery, erection, commissioning and maintenance of the major components of the turbines (e.g., blade lifts), Argyll and Bute Council would be notified in advance of such occurrences. Working hours will be subject to agreement between the Contractor and Argyll and Bute Council and regulated via the Construction Environment Management Plan (CEMP) and by planning conditions. In addition, adherence to working hours will be contractually implemented between the Applicant and the Contractor. • Good public relations and consultation with Argyll and Bute Council will be essential to help minimise the impacts of construction work. A Community Liaison Group (CLG) will be established to ensure that local residents are kept informed of construction activities and progress. The CLG will be informed of any periods of more intense construction activity or night-time working which may result in increased noise levels, and • A dedicated contact number for local residents to phone should they have any queries or complaints will be maintained during the construction works. A log will be kept of all complaints, along with the actions taken to resolve them, for the duration of the works.
		Requirements for noise monitoring in the event of a complaint arising will be included as a condition of planning consent.

Chapter	Chapter Title	Mitigation
9	Ecology	A Habitat Management Plan (HMP) will be produced. The primary components will be the provision of compensatory blanket bog restoration, borrow pit restoration, and the provision of compensatory tree planting for limited broadleaved woodland loss associated with the lower part of the access track from the A83, and habitat protection measures.
		Unmitigated loss of blanket bog is predicted to be significant given the degree of importance assigned to blanket bog. It has therefore been agreed that compensatory peatland restoration will be carried out, with a 56.2 ha area identified in an area currently largely planted with Sitka spruce. The peatland restoration will only commence after the existing plantation woodland is felled and removed by Forestry and Land Scotland (FLS).
		The initial success of the peatland restoration measures will be monitored and remedial action taken if necessary (e.g. in the event of failure of water retention measures). The Applicant will work with FLS to maintain the restored peatland area.
		Restoration of borrow pits will adhere to the planting proposals set out in the updated Carradale LMP. Where restoration is required to open habitat, including borrow pit BP06 at the edge of the north-western moorland, the restoration will be advised by the Ecological Clerk of Works and with liaison with FLS where appropriate.
		Loss of broadleaved trees will be compensated by nearby tree planting, with a preference for implementation next to the access track of native broadleaved species of local provenance that are appropriate to the locality. Where semi-natural broadleaved woodland is lost, then in line with good industry practice and acknowledging that planted trees cannot replace semi-natural woodland, the area of planting will be three times the area lost. Where non-semi-natural broadleaved woodland is lost, the replacement area will be at least the same. Appropriate species to simulate the canopy and shrub layers of a natural low altitude woodland type in this region, such as NVC types W11 or W17, comprise downy birch *Betula pubescens*, hazel, sessile oak *Quercus petraea* and, in small proportion, rowan *Sorbus aucuparia* and holly *Ilex aquifolium*.
		The success of the above tree planting will be monitored for three years, and remedial action taken in the unlikely event that establishment fails.
		Habitat protection measures will comprise embedded measures set out in the CEMP regarding pollution prevention, and tasks performed by the Ecological or Environmental Clerk of Works, such as monitoring pollution control measures, the above compensatory habitat measures, and advising on infrastructure micro-siting and habitat reinstatement.

Chapter	Chapter Title	Mitigation
		To comply with protected species legislation, policy and good industry practice, protected species surveys will be carried out no more than 12 months before commencement of works. For clarity, the works are taken to include the limited tree felling carried out specifically for the Proposed Development, but not felling carried out by FLS under the updated Carradale LMP. Ideally, they will not be carried out less than two months before works commence, in order to avoid project delays in the event that derogation licensing and associated mitigation is required (should protected species refuges be found that will be subject to damage, disturbance or obstruction by the works). The surveys will cover protected species known to occur in the vicinity of proposed works, or for which there is a reasonable possibility of such species moving into this vicinity. This will comprise surveys for otter, pine marten / wildcat, red squirrel dreys and badger, as well as a bat roost suitability survey of broadleaved trees to be felled or lopped along the lower access track from the A83. These surveys will follow standard guidance and will take place within the survey buffers typically required by NatureScot.
		The limited required tree felling for the Proposed Development will as far as possible be carried out outside the breeding bird season (taken to be March to August, inclusive), and (except where it is clear that red squirrel dreys are absent) outside of the red squirrel breeding season (February to September, inclusive). Where this is not possible, the Ecological Clerk of Works will make checks for nesting birds and red squirrel dreys prior to any tree felling activity,
		Where protected species refuges such as red squirrel dreys, pine marten dens or otter holts are found to be present, the Ecological Clerk of Works will advise on the minimum distance that tree felling or works may approach and will obtain derogation licence(s) prior to works proceeding that are liable to cause damage, disturbance or obstruction of such protected species refuges.
		Excavations will be provided with a means of escape for animals that may fall in overnight, such as a ramp or battered slope.
		Except where required to remain open for passage of water, pipes that animals could enter will be capped overnight.
		Artificial lighting will be avoided as far as possible, and where required will be directional to minimise light-spill onto surrounding terrestrial habitats and watercourses.

Chapter	Chapter Title	Mitigation
		An Ecological Clerk of Works will be appointed to provide ecological supervision and advice for and during construction as necessary. The tasks of the Ecological Clerk of Works will include: • Pre-commencement checks including the protected survey update proposed above, • Advising on exact infrastructure placement within the micro-siting tolerances, • Monitoring of and advising on storage of overburden to minimise habitat damage, • Monitoring of any peat / turves that may be stored for later reinstatement, • Advising on habitat reinstatement, such as at temporary quarries (borrow pits), including where possible biodiversity priorities, • Monitoring of pollution control measures and advising on placement of ditches, settlement ponds, etc. to minimise habitat damage, • Monitoring of protected species, and liaising appropriately to resolve any issues that arise, if necessary, including obtaining further derogation licence(s) and developing associated proportionate mitigation, and • Monitoring of compensatory habitat measures (blanket bog restoration and tree planting).
10	Ornithology	An Ecological Clerk of Works will be employed on a full-time basis for the duration of the construction of the Proposed Development and will also cover ornithology. The Ecological Clerk of Works will be responsible for monitoring and ensuring the implementation of all mitigation measures and compliance with legislative requirements in relation to ornithological features. The Ecological Clerk of Works will also carry out pre-works checks for breeding birds and provide other advice in relation to ornithological features, as appropriate.
		Throughout the construction, and where necessary decommissioning, phases, a programme of breeding bird surveys will be carried out within the potential Zone of Influence of the Proposed Development, as adopted during the pre-construction surveys which have informed this EIA. The surveys will be carried out by a suitably experienced ornithologist(s) and will follow good industry practice methods, similar to those described in Chapter 10: Ornithology (EIAR Volume 2a). The results of on-going surveys will be communicated to relevant construction personnel to ensure that appropriate mitigation is implemented to protect identified breeding birds. The detailed programme of breeding bird surveys will be set out in a Species Protection Plan (SPP), which will be approved by Argyll and Bute Council, in consultation with NatureScot, prior to the commencement of construction and/or decommissioning works.

Chapter	Chapter Title	Mitigation
		All construction personnel and staff involved in the operation of the Proposed Development will be made aware of the ornithological features at the Development Site and the mitigation measures and working procedures which must be adopted. This will be achieved as part of the induction process through the delivery of a Toolbox Talk. In addition, as required, briefings will also be provided in advance of works which are considered to present an increased risk of impacting ornithological features.
		Wherever possible, vegetation clearance (i.e. the keyhole felling around wind turbines T02, T04, T05, T06, T08, T10, T11 and T13, but not including clear felling being carried out independently by FLS) will be undertaken outside of the breeding season, this being between March and August, inclusive. Where this cannot be achieved, a pre-works check for the presence of nesting birds will be conducted by the Ecological Clerk of Works or other suitably experienced ornithologist. Consideration will be given to the use of innovative techniques for locating ground-nesting birds, including the use of thermal imaging cameras mounted onto unmanned aerial vehicles (‘drones’). Pre-works checks for nesting birds should take place not more than 72 hours prior to the commencement of works as nests can be quickly established. Where any active nest sites are identified, suitable species-specific exclusion zones will be implemented and maintained until the breeding attempt has concluded. If a bird listed on Schedule 1 of the Wildlife and Countryside Act (1981) (WCA) is confirmed as, or is suspected to be, breeding, the works exclusion zone will be informed by the information provided in Ruddock and Whitfield (2007) and the site-specific characteristics of the nest site, including topography and the presence of screening (e.g. woodland). The size of the exclusion zone around the nests of birds listed on Schedule 1 of the WCA will be agreed with NatureScot. Full details of the requirements in relation to the protection of breeding birds, included recommended sizes for works exclusion zones, will be included within the SPP.
		A Construction Environmental Management Plan (CEMP) will be prepared. The CEMP will be approved by Argyll and Bute Council, Scottish Environment Protection Agency (SEPA) and NatureScot (where relevant) prior to commencement of construction. It will set out general environmental measures, including pollution prevention, and the roles and responsibilities of construction personnel. The CEMP will include, as a minimum, a Pollution Prevention Plan, Water Management Plan and Dust Management Plan.
		SEPA Pollution Prevention Guidelines (PPG) and Guidance on Pollution Prevention (GPP) will be followed at all times during the construction, operation and decommissioning of the Proposed Development.
		Controls and contingency measures will be provided to manage run-off from construction areas and to manage sediment.

Chapter	Chapter Title	Mitigation
		In order to avoid potential pollution impacts to vegetation and watercourses from machinery during construction, all refuelling and servicing of vehicles and plant will be carried out in a designated area which is bunded and has an impermeable base. This will be situated away from sensitive habitats and at least 50m from any watercourse.
		Measures to avoid dust generation will be implemented as required during the construction phase.
		All construction compounds, access tracks and other works areas will be of the minimum size required for the safe construction of the Proposed Development. Compounds will be fenced to prevent encroachment of personnel, machinery and materials onto adjacent habitats. The temporary stockpiling of materials will be restricted to predetermined locations, such as compounds, and will not be done on undisturbed adjacent habitats.
		Construction works will take place within a clearly demarcated area.
		Where practicable, works near or at any retained trees (relevant only to the main access track) will follow guidance detailed in British Standard 5837:2021 Trees in relation to design, demolition and construction – Recommendations.
		Sightings of protected and/or notable bird species within the Development Site during the construction period will be recorded. If any evidence or sightings of specially protected bird species listed on Schedule 1 of the WCA suggest that a nest site may be present within 1km of active or planned near term works, then works in that area will stop immediately and the Ecological Clerk of Works will be contacted for further advice.
		The access roads to T01, T03 and T04 will be micro-sited, where necessary and as far as possible, to minimise damage to or loss of flush or other important wetland habitats, including groundwater dependent terrestrial ecosystems.
		As far as possible, the access tracks will be constructed via a ‘floating’ method if peat depths exceed 2m, which retains the underlying substrate *in situ* and promotes continued flow of groundwater.
		Where floating track construction cannot be adopted, the access track will be constructed so as to permit the continued flow of surface water from one side to the other. This will involve the installation of culverts or small cross-pipes, incorporated at regular intervals and in particular in areas of obvious water flow.

Chapter	Chapter Title	Mitigation
		No black grouse leks were identified within 500m of any proposed infrastructure during surveys carried out between 2014 and 2020. However, should a black grouse lek be identified by during-construction (or decommissioning) ornithological surveys within 500m of any construction area, no works will be permitted to take place during the period of one hour before sunrise until one hour after sunset, in the months of April and May. This will ensure there is no disturbance to displaying black grouse.
		Throughout the construction phase, the Ecological Clerk of Works or another suitably experienced ornithologist will be responsible for carrying out a full programme of survey for sensitive bird species, namely lekking black grouse, breeding waders, breeding raptors and breeding divers. These surveys will follow good practice guidelines as adopted during the fieldwork completed to inform this EIA and referenced in Section 10.3 of Chapter 10 (EIAR Volume 2a). The purpose of these surveys will be to determine if and where sensitive bird species establish nest sites, and to therefore allow for appropriate avoidance and/or mitigation measures to be implemented to avoid or minimise impacts upon them. This will be particularly relevant to those bird species listed on Schedule 1 of the WCA, which may not be disturbed when actively breeding. Full details of the during-construction ornithological monitoring programme will be set out in the Species Protection Plan for the Proposed Development, to be submitted to NatureScot in advance of the commencement of construction. The results of all during-construction ornithological survey will be provided to NatureScot and the Argyll Raptor Study Group.
		See Confidential Annex 10.1 (EIAR Volume 4) for golden eagle and hen harrier mitigation and monitoring.
11	Geology, Hydrology and Hydrogeology	A Construction Method Statement (CMS) will be developed and adhered to in the course of construction of the Proposed Development following planning permission.
		Pre-construction drainage will be installed including interception drains and settlement lagoons to ensure natural drainage pathways are preserved as closely as possible and not mixed with construction drainage. Swales will be created during access road construction as well as regular cross drains to collect construction drainage and route it through the settlement lagoons before discharging to natural ground. Swales and interception ditches will generally be shallow to avoid altering the natural ground water pathways or lower the natural water table. Temporary and permanent drainage for the Proposed Development will be part of a pre-construction Sustainable Drainage System (SuDS) design.

Chapter	Chapter Title	Mitigation
		There is not considered to be a risk of the works increasing flooding upstream or downstream of the study area. As such, it is proposed to install closed pipe and single span bridges in accordance with SEPA's 'Engineering in the Water Environment Good Practice; Construction of River Crossing' (SEPA, 2010).
		Pollution from run-off from access tracks and river crossings will be reduced by brushing or scraping roads to reduce dust and mud deposits and installation of small dams in artificial roadside ditches to retain silt. Where possible, work will be conducted an appropriate distance from the bank and not in the river (GPP5).
		Installation of turbine foundations and cable trenches will generally be carried out during periods of dry weather. An appropriate construction method statement will be produced to ensure any groundwater ingress is managed suitably. If required, a sump will be created and ground water pumped back onto natural ground to maintain the groundwater level and ensure sediment is not transferred to watercourses. Direct discharge of pumped groundwater to watercourses will not be permitted.
		Concrete pouring will be sited a minimum of 10m from any surface drains (new or existing [unmodified]) and 50m from any watercourse and sensitive receptors to minimise the risk of run off entering a watercourse (as set out in GPP5 and PPG6).
		The proposed new temporary quarries (borrow pits) have been located within the Development Site in areas where there are no identified constraints (e.g., water courses, deep peat). Any groundwater ingress will need to be managed during construction by creating a sump area and pumping into a settlement lagoon before discharging to natural ground. Discharging water directly to a watercourse will not be permitted.
		Drainage will be installed at crane pads as well as at temporary hardstanding areas such as the construction compound / battery storage area. Drainage installed at crane pads in general will discharge via settlement lagoons unless they are located at a significant distance away from watercourses or sensitive receptors. Settlement lagoons will be appropriately sized.
		Refuelling areas at the construction compound / battery storage area will be bunded and discharge via both an oil separator and SuDS, such as a natural soakaway located within the construction compound area. All construction equipment is to be equipped with emergency spill kits and the operatives trained as to how to use them.
		Ground investigations following receipt of planning permission, to be carried out post-consent, will confirm soil and rock properties to assist the detailed design. Geotechnical properties for access tracks and other hardstanding construction and water crossings

Chapter	Chapter Title	Mitigation
		design will also be confirmed during the ground investigation. Following the ground investigation, turbines/ infrastructure will be micro-sited away from any variable and/or poor ground conditions.
		Peat will be encountered during construction of the Proposed Development. Design and construction of the Proposed Development will be carried out in accordance with good industry practice, as detailed in Table 11-2 (Chapter 11; EIAR Volume 2a). Excavations will be prevented from drying out or desiccating as far as possible. This can be achieved by minimising disturbance or movement of the spoil peat once excavated. Consideration will also be given to spraying the peat to keep it moist in appropriate circumstances. Stockpiling of peat will be located in areas of minimal risk from erosion and water quality deterioration, with an appropriate buffer from watercourses. Designated areas for stockpiling / side casting will be generally flat and stable, and side casting will be restricted to thin layers of fibrous peat (as encountered during the walkover). Where required, peat will be stockpiled taking due regard to potential loading effects for peat slide risk. Stockpiles will be bladed off at the side to minimise the available drying surface area. Where surface run-off may be encountered, stockpiles will be bunded, whereby bunds will extend above the toe level of the stockpile and water quality monitored before discharge.
		The peat will be restored as soon as possible after disturbance. During construction of access tracks and crane pads, mitigation can be undertaken as access road construction progresses. However, for small temporary quarries reinstatement cannot be undertaken until extraction is complete.
		Mitigation measures in relation to the soil environment include use of good practice during construction to prevent or minimise spillage risk and spillage effects. The ‘Good Practice during Wind Farm Construction’ guidance from SNH et al. (2019) and ‘Advising on carbon-rich soils, deep peat and priority peatland habitat in development management’ from NatureScot (2021) will be used to inform a CMS to be approved by SEPA and Argyll and Bute Council, and will be developed covering each construction activity before construction commences. This will include compliance with all of the guidance contained in relevant GPPs and PPGs.
		Access tracks will be designed such that they do not become a conduit for water flow. A cross-fall or camber will shed water to swales on either one or both sides of the access tracks. Cross drains will be installed at low points and as otherwise required to remove surface water from the access tracks. Intermittent maintenance will be carried out during the operational phase.
		Construction of new access tracks has been minimised by utilising existing access tracks where possible and where possible avoiding areas of deeper peat.

Chapter	Chapter Title	Mitigation
		Settlement lagoons will be removed following construction to avoid encouraging birds and reducing the collision risk. During detailed design, an assessment will be made of the most appropriate drainage layout for the operational phase.
		Appropriate concrete will be used in the turbine foundations to minimise the risk of residues polluting the groundwater.
		Mitigation proposed during decommissioning stage will be very similar to the construction stage. A decommissioning management plan will be prepared and relevant statutory consultees contacted prior to any decommissioning works. The plan will adhere to best practice guidance and legislation in place at that time.
12	Cultural Heritage	The exact positions of the turbines, access tracks and associated infrastructure are subject to a micro-siting allowance of between 50m to 100m (see Chapter 3: Project Description (EIAR Volume 2a) for further detail). Due to the potential for unknown archaeological deposits to exist within the forested areas of the Development Site and along the length of the access track following the line of the Kintyre Way, a phased programme of archaeological work will be carried out pre-construction to identify unknown archaeological remains.
		The phased programme of archaeological work will be developed in consultation with the Council's Archaeological Advisor; however, should include a watching brief during the deforestation due to be undertaken prior to ground investigation works, and subsequent construction work, to identify any remains including additional cup and ring marked stones. A site walkover by an archaeologist should also be conducted of those areas of the Proposed Development not accessible during the walkover survey. A Written Scheme of Investigation outlining the planned work would be submitted to the Council's Archaeological Advisor for agreement prior to clearance or enabling works and construction. Further archaeological work may follow if required.
		Prior to widening commencing on the access track along the Kintyre Way, the exact location of the quarries believed to lie within the line of the track should be identified. If it is established that the quarries are extant, photographic recording of the quarries should be undertaken prior to any widening works commencing. If it is established that the quarries were removed during previous phases of track development, no further works will be required.

Chapter	Chapter Title	Mitigation
		Although there are no appropriate mitigation measures for operational effects on the setting of heritage assets, the provision of suitable interpretive material about the archaeology of the area, specifically the cup marked stones, crofts, and the shieling grounds could be considered. This would be constructed in a suitable location and could potentially be linked with the Kintyre Way long distance footpath.
13	Socio-economic, Recreation and Tourism	In order to mitigate against delays and amenity loss associated with construction traffic, a Construction Traffic Management Plan (CTMP) will be produced during the post-planning stage and approved in consultation with Police Scotland, Argyll and Bute Council and Transport Scotland.
		The CTMP will set out in detail: • Measures to mitigate access restrictions and pedestrian safety along the Kintyre Way, • Details of advanced notification to the general public, warning of turbine component transport movements, • Details of informative road signage warning other users of forthcoming turbine component transport and construction traffic movements, • Arrangements for regular road maintenance and cleaning, e.g. road sweeping in the vicinity of the site access point as necessary, wheel cleaning / dirt control arrangements, • Specific timing of deliveries outside peak traffic hours on the A83, and • The briefing of drivers on pulling over to the side of the road at suitably safe locations to allow other road users to overtake safely, and the CTMP will take seasonal sensitivities into account wherever practicable.
		The CTMP will include details on mitigation for maintaining access to the Kintrye Way during construction; however, it is expected that public access along the stretch of the Kintyre Way that coincides with the Proposed Development access route is likely to temporarily be restricted during construction to ensure works are carried out safely (e.g. temporarily stopping access during deliveries); see 'Traffic, Transport and Access' below for further detail. Signage will be used to raise awareness of construction and promote safe use of alternative routes and temporary footpaths around the Proposed Development. The Applicant will provide adequate signage and appropriate advertising of any temporary restrictions to access. Further details will be provided in the CTMP to be prepared post consent.

Chapter	Chapter Title	Mitigation
		A Meet the Developer Day will be held if planning consent is granted to inform and to open discussions with local business about the opportunities that may exist during construction and operation of the Proposed Development. As proposed in Renewable UK's (2014) good practice guide for local supply chains, the main aim of the event will be to actively engage local businesses in the construction supply chain. Direct and indirect investment in the local economy will be further encouraged through the appointed Contractor who will prepare a database of local suppliers (e.g. plant, materials, guest houses, bed and breakfasts) to ensure that local services are used as much as practicable during the construction period.
		The potential adverse and beneficial effects that could arise during the decommissioning phase are similar to those identified for the construction phase. For this reason, mitigation measures are also likely to be similar. These will include developing an appropriate CTMP to ensure that construction related traffic does not cause unnecessary delays that could deter tourists from coming to or remaining in the area.
14	Traffic, Transport and Access	Environmental effects relating to construction traffic will be mitigated throughout the construction period by an appropriately focused CTMP. The CTMP will promote, implement, and monitor the safe and efficient transportation of components and materials to the Development Site. It will aim to minimise congestion, disruption and maintain road safety. The CTMP will be produced during the post planning stage and approved in consultation with Police Scotland, Argyll and Bute Council and Transport Scotland. It will ensure that construction traffic is managed and routed to the site to ensure Heavy Goods Vehicles (HGV) movements are in accordance with forecast.
		The CTMP will include a requirement for construction vehicles to give particular attention to locations where pedestrian traffic and crossing points are present, to ensure effects on severance are minimised and also that effects on pedestrian and cycle delay are minimised.
		The CTMP will also ensure construction traffic activities will be mindful of vehicle speeds and manoeuvring / proximity to vulnerable road users in all locations and instances within the study area where potential exposure to fear and intimidation could result.
		The CTMP will promote best practice for commercial vehicle operators in terms of road safety to limit the potential for road traffic accidents.

Chapter	Chapter Title	Mitigation
		The CTMP will include a requirement for construction vehicles to give particular attention to locations where pedestrian and cycle traffic are present, to ensure effects on pedestrian and cycle amenity are minimised.
		The CTMP will include details on maintaining access to the Kintyre Way during construction of the Proposed Development. Access to the Kintyre Way will be maintained during construction, and any temporary closures and diversion routes will be agreed in advance with Council Access Officers, including appropriate advanced notification and signage. Diversion routes are likely to be localised temporary paths adjacent to the route of the Kintyre Way. These will allow pedestrian and cycle traffic to safely negotiate locations on the Kintyre Way where the potential for interaction with construction traffic may affect pedestrian and cycle amenity.
		Abnormal Indivisible Loads (AIL) carrying items such as wind turbine blades will be escorted and can be scheduled to travel when roads are quieter. AIL vehicle escorts can enact rolling traffic management control to address any localised queuing and delay resulting from the presence of slow-moving construction traffic, to ensure effects on driver delay are minimised.
		The CTMP will include but not be limited to: • The proposed route for construction traffic including abnormal loads, • The necessary agreements and timing restrictions for construction traffic. This may include the restriction of the number of daily HGV vehicle movements, if deemed necessary by the planning authority, • Details of proposed Condition Survey on access routes, • Proposals for abnormal maintenance of these routes during (and attributable to) construction, Proposals for monitoring and agreeing (abnormal maintenance) costs attributable to construction of the Proposed Development, Escort arrangements for abnormal loads, • Details on mitigation to be provided for maintaining access to, and along, the Kintyre Way during construction, • Route signing, • Details of advanced notification to the public, warning of turbine component transport movements, including on the Kintyre Way,

Chapter	Chapter Title	Mitigation
		• Details of informative road signage warning other users of forthcoming turbine component transport and construction traffic movements, including signing of alternative localised paths adjacent to the Kintyre Way serving as diversion routes for pedestrian traffic, • Arrangements for regular road cleaning, e.g., road sweeping in the vicinity of the Development Site access point as necessary, wheel cleaning / dirt control arrangements, • Specific timing of deliveries outside peak traffic hours on the A83, • The briefing of drivers on pulling over to the side of the road at suitably safe locations to allow other road users to overtake safely, • Contractor speed limits, • Community and emergency services liaison details, and • Details of potential impact with timber haulage routes and mitigation.
15	Infrastructure	The Applicant will continue to engage with service providers throughout the construction phase to ensure that the micro-siting of the Proposed Development will not cause adverse effects to existing infrastructure.
		The overhead line crossing the Development Site entrance, as identified by SSE, will be undergrounded prior to works commencing, if necessary, for safety during construction.
		In accordance with standard industry good practice, any nuisance complaints from residents regarding television or radio reception during construction or operation will be followed up and mitigation measures implemented if necessary. Example mitigation measures may include installation of a satellite dish to receive Freesat or a free-to-air digital satellite television that should not be affected by the Proposed Development.
16	Aviation	The Proposed Development will need to be illuminated with Civil Aviation Authority and Ministry of Defence compliant aviation lighting. A detailed lighting assessment has been undertaken which assessed which turbines will need to be illuminated with the lighting layout. Table 16-3 within Chapter 16 (EIAR Volume 2a) provides details on this.

Chapter	Chapter Title	Mitigation
17	Forestry	The large majority of timber harvesting from the Forest Study Area will be carried out under the auspices of the updated Carradale LMP (FLS, *unpublished*) by FLS as part of normal harvesting activity.
		The small area of woodland (26.50 ha) to be cleared in advance for the Proposed Development for key-hole requirements if consented, will produce a limited volume of merchantable timber. Any merchantable timber will be dispatched via the existing forest road network to the A83 and thereafter to appropriate markets.
		Any harvesting and timber extraction will be carried out using conventional techniques and equipment. Brash will be used to provide tracks for machine operation.
		Stemwood down to 7cm diameter will be extracted for sale. Timber production will be maximised by considering all available markets including wood fuel.
18	Shadow Flicker	No routine mitigation is proposed; this will however be kept under review during the operation of the Proposed Development in case particular combinations of circumstances arise that increase the potential for disturbance (particularly where rooms affected are in regular occupancy and the effect proves to be a frequent occurrence).
		Where issues arise, mitigation measures such as standard shadow flicker controllers can be installed on turbines to shut them down when all parameters needed to cause shadow flicker are present, thereby eliminating the problem. Other options such as screening affected dwellings from turbines could also be implemented.

RWE

Clachaig Glen Wind Farm

Environmental Impact Assessment Report

Volume 3

Technical Appendices

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