

Craiginmoddie Wind Farm

Environmental Impact Assessment Report Chapter 9: Ecology

December 2020

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9 ECOLOGY

Introduction

- 9.1 This assessment has been carried out by Gavia Environmental Ltd ('GEL') typically following NatureScot (formerly Scottish Natural Heritage, or SNH) guidelines (2012, 2016, 2018a & 2018b). This chapter evaluates the likely significant environmental effects on the ecological receptors associated with the construction, operation and decommissioning of the proposed Craiginmoddie Wind Farm development (hereafter referred to as the 'Proposed Development') and also a section of additional off-site access track, located to the north west of the main development (See Technical Appendix 9.1: Phase 1, NVC & GWDTE Report & Technical Appendix 9.1: Protected Species Report).
- 9.2 All staff who have contributed to fieldwork and this chapter have an undergraduate or higher postgraduate degrees in relevant subjects, hold professional membership of the Chartered Institute of Ecology and Environmental Management (CIEEM) Institute of Environmental Management and Assessment (IEMA) or the Royal Society of Biology (RSB). Christopher Baker, Chartered Environmentalist, and Director of Gavia Environmental Limited (GEL) reviewed the Chapter.
- 9.3 Where relevant, all Figures and Technical Appendices are referenced within the text. The naming structure used in this chapter follows common names except where no common name is typically used, followed by the scientific name (upon the first usage). Full scientific names and comprehensive species lists are provided in the Technical Appendices.

Legislation, Policy & Guidance

Legislation

- The 'European Habitats Directive' (1992), Council Directive 92/43/EEC;
- The 'Water Framework Directive' (2000), Council Directive 2000/60/EC;
- Wildlife and Countryside Act 1981 (as amended);
- The 'Habitat Regulations', Conservation (Natural Habitats, & c) regulations (1994) ;
- Wildlife and Natural Environment (Scotland) Act 2011;
- Nature Conservation (Scotland) Act 2004;
- Protection of Badgers Act 1992; and
- Salmon and Freshwater Fisheries Act 2003.

Policy

- Guidelines for Ecological Impact Assessment (EcIA) (CIEEM, 2018);
- South Ayrshire Council Local Development Plan (LDP1)(South Ayrshire Council, 2014);
- South Ayrshire Modified Proposed Local Development Plan 2 (MPLDP2) (South Ayrshire Council, 2020);

- Planning Advice Note (PAN) 60: Planning for Natural Heritage (Scottish Government, 2008); and
- Guidance on Assessing the Impacts of Windfarm Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems (GWDTE) (SEPA, 2017).

Guidance

- Scottish Biodiversity List (Scottish Government, 2020)
- 2020 Challenge for Scotland's Biodiversity (Scottish Government 2015);
- South Ayrshire Local Biodiversity Action Plan (LBAP) 2007 -20010 (South Ayrshire Council, 2008);
- Good practice during Wind Farm construction (NatureScot, 2019); and
- Bats and onshore wind turbines (NatureScot, 2019).

Consultation Responses

- 9.4 A scoping report was issued to the Energy Consents Unit (ECU) in June 2020. The following organisations provided Scoping comments: NatureScot, Scottish Environment Protection Agency (SEPA), Marine Scotland Science (MSS) Ayrshire Rivers Trust and the Royal Society for the Protection of Birds (RSPB). A summary of consultation responses is presented in Table 9.1.

Table 9.1 Consultation Responses

Consultee and Date	Comments & Summary of Issues raised	Addressed in the section of Chapter
NatureScot 6th July 2020	Confirmed that the key ecological features and survey and assessment methods presented in the Scoping Report. Indicated that Blair Farm Site of Special Scientific Interest (SSSI), Knockgardner SSSI and Auchalton SSSI have no connectivity with the Proposed Development and can be scoped out of the assessment. They acknowledged that the Development might impact several species and advised that species surveys should be no more than 18 months old before submission. NatureScot stated that The Environmental Statement must include full survey details for protected species. If Deer will be significantly impacted, then a draft deer management plan should be provided. NatureScot requires agreed species protections plans, habitat management	Addressed throughout. Addressed in Technical Appendix 9.1 and Section 9.40. Addressed throughout. See section 9.72-9.79 for general mitigation. Addressed in Technical Appendix 9.2, Technical Appendix 9.3, and Technical Appendix 9.4. Addressed in section 9.7 and 9.135 See Technical Appendix 9.1, Technical Appendix 9.2, Technical

	plans and appropriate licences for any protected species which will be impacted after implementation of proposed mitigation.	Appendix 9.3, and Technical Appendix 9.4. See section 9.135
Scottish Environment Protection Agency (SEPA)	Confirmed habitat survey information not required for heavily forested areas. Proposed Development must avoid impacts to GWDTE and provide a map demonstrating all GWDTE are outwith 100 m of excavations shallower than 1m and 250 m of excavations deeper than 1 m.	Addressed in Technical Appendix 9.2, and Chapter 12: Hydrology, Hydrogeology and Geology.
Marine Scotland Science (MSS)	Recommend site characterisation surveys to assess presence and abundance of fish species which could be impacted by the Proposed Development. The potential impact of felling on water quality and fish populations should be considered. Cumulative impacts on fisheries and hydrology should be assessed.	Fish and freshwater pearl mussel habitat assessment has been undertaken (see Technical Appendix 9.4). See Chapter 12: Hydrology, Hydrogeology and Geology for water quality mitigation.
Ayrshire Rivers Trust	Noted that the Proposed Development has the potential to impact on the water environment due to proximity to important tributaries of the River Stinchar and the River Girvan. ES should assess the impacts of forest felling, and construction should not impede fish movement or increase silt loading of watercourses. Recommended invertebrate sampling was undertaken, before during and after construction to supplement water quality monitoring.	Fish and freshwater pearl mussel habitat assessment has been undertaken (see Technical Appendix 9.4) See Chapter 12: Hydrology, Hydrogeology and Geology for water quality mitigation.
Royal Society for the Protection of Birds (RSPB)	Happy with stakeholders consulted and proposed surveys and assessment for ornithology. No further comments on ecological features.	Addressed in Chapter 8: Ornithology.

Effects scoped out

- 9.5 This assessment considers sensitive ecological receptors which are likely to be impacted during the construction, operation or decommissioning phases of the Proposed Development. Where no likely significant environmental effects are anticipated on an ecological feature, where a feature is not considered at a significant level or where no legal protections are afforded to a feature, these have been scoped out of any further assessment.

- 9.6 Assessment of statutory designated sites, which have a qualifying ecological feature, within 10 km of the Proposed Development, have been scoped out, due to lack of connectivity between the designated site and the Proposed Development. NatureScot also highlighted that they did not consider that the Proposed Development would have an adverse effect on nearby designated sites.
- 9.7 Incidental observations of deer were recorded during the protected species surveys (see Technical Appendix 9.2: Protected Species Survey Report). At present deer are actively managed through on-site stalking within the plantation on site and it is assumed that this will continue through the operational phase with coordination from all landowners involved. Deer will also be considered as part of a Habitat Management Plan (HMP), see section 9.135. As a result of the current, and continued management of deer it is not expected the Proposed Development will significantly impact deer and as such, deer have been scoped out of any further assessment.
- 9.8 GEL undertook protected species surveys across September 2019, June July & September 2020. These are detailed in:
- Technical Appendix 9.2: Protected Species Report.
 - Technical Appendix 9.3: Bat Survey Report
 - Technical Appendix 9.4 Fish Habitat Survey (Inc. Freshwater Pearl Mussel).
- 9.9 GEL Surveyors recorded no evidence of red squirrel, water vole or freshwater pearl mussel (FWPM) and as such these species have been scoped out of any further assessment but will be considered during pre-construction surveys.
- 9.10 All habitats which are of low ecological value (Table 9.13) or not considered to be impacted by the Proposed Development have been scoped out of any further assessment.
- 9.11 Following desk and field study results reptile and amphibians have been scoped out of any further assessment. GEL recorded the following herptiles, common frog, common lizard and a small female palmate newt incidentally during the protected species surveys. These species are recognised to be of intrinsic biodiversity value, and in the case of common lizard receive protection under the Wildlife and Countryside Act 1981 (as amended in Scotland), they are generally common and widespread within South Ayrshire and as such not adversely effected by the Proposed Development. As such, these species have been scoped out of any further assessment but will be considered during pre-construction surveys to ensure legal compliance with wildlife legislation.

Scope of Assessment

Assessment Methodology

- 9.12 The approach taken for the EcIA largely follows CIEEM guidance (2018) which sets out the following stages of assessment:
- Establishing a baseline, identification and characterisation of ecological features and effects.

- Determine the importance of identified ecological features.
- Characterise potential impacts and significance of effects on ecological features.
- Incorporation of mitigation measures and assessment of residual effects after implementation.
- Identification of ecological enhancement opportunities.

Baseline Characterisation

Study Area

- 9.13 The following geographic definitions are used within this chapter to describe the Proposed Development and associated study areas (Table 9.2.).

Table 9.2: Study Area Definitions

Term	Definition
The Proposed Development	Refers to the whole process involved with the lifetime of Craiginmoddie wind farm including construction, operation and decommissioning.
The Site	The Site comprises the area encompassed by the redline site boundary, the turbine envelope and associated infrastructure, as well as the creation of a new section of access track located c. 1.6 km north of the main Site area as shown in Figure 9.1.
The Survey Area	The area within which any desk study or ecological survey has been undertaken. This area varies depending on the nature of the survey being undertaken, and these are detailed within the associated technical appendices.

- 9.14 The Site is located in a Landscape Character Type (LCT) classified as 'Foothills with Forest and Wind Farms' LCT as identified in the South Ayrshire Landscape Wind Capacity Study (LWCS). This LCT combines a subdivision of the broader Foothills with Forest LCT with a subdivision of the Foothills LCT as identified in the original Ayrshire Landscape Character Area study. It reflects the change in character through the introduction of the Hadyard Hill Wind Farm, which lies adjacent to the west. The LCT comprises a mix of improved grassland, unimproved grassland and commercial forestry plantations. Full details of the Proposed Development are detailed in Chapter 3: Project Description and Construction Methods.

Desk Study

- 9.15 GEL undertook desk studies before the commencement of all ecological surveys to identify statutory designated nature conservation sites within 10 km of the Site boundary

and to identify all known records of important ecological receptors within a 5 km radius of the Survey Area within the last ten years. GEL sourced data from NatureScot's SiteLink website (NatureScot, 2020), the Department for Environment, Food & Rural Affairs (DEFRA) MAGIC Map (DEFRA, 2020), National Biodiversity Network Atlas (2020) (using records available for commercial use), the LBAP, the Hadyard Hill extension Wind Farm Environmental Statement (SSE, 2015) and the British Geological Society (BGS, 2020) digital maps.

Baseline Surveys

Habitats

Phase 1 Habitat Survey

- 9.16 A Phase 1 Habitat survey was undertaken in 2019 and updated in 2020 (to account for the main access track into the Site). The survey was undertaken according to the "Phase 1 Habitat Survey" method, as recommended in the guidelines for baseline ecological assessment (JNCC, 2010) and 'Guidelines for Preliminary Ecological Appraisal' (CIEEM, 2017). Full methods are presented in Technical Appendix 9.1.

National Vegetation Classification (NVC) Survey

- 9.17 Following the broad habitat types mapped in the Phase 1 Survey, an NVC survey was undertaken in September 2019 and updated in July 2020 to include the additional extension to the original survey area and again in October 2020 to include the new access track layout into the Site from the west. Vegetation was mapped and described following the JNCC NVC 'Users Handbook' (JNCC, 2006). Full methods are presented in Technical Appendix 9.1.

Groundwater Dependent Terrestrial Ecosystems (GWDTE) Survey

- 9.18 Following the results of the NVC survey, GEL assessed GWDTE potential against 'Land Use Planning System Guidance Note 4 Planning Guidance on Windfarms' (LUPS GU4) (SEPA, 2017). GEL systematically sampled any NVC community, identified as a 'moderate' or 'high' potential GWDTE, in the field to assess water chemistry. The purpose of this in situ testing was to determine the water supply mechanism to each habitat. Water quality sampling was excluded from areas of plantation woodland as it is considered the groundwater table has been already disturbed. Full methods are presented in Technical Appendix 9.1.

Protected Species (Excluding Bats)

- 9.19 GEL Ecologists undertook an initial walkover of the Survey Area in September 2019. Following the extension of the Proposed Development in 2020, GEL revisited and undertook protected species walkovers of the Proposed Development in June, July and September 2020. Survey area encompassed the redline site boundary and a buffer of up to 250 m to assess the presence or likely presence of protected species. However, GEL also recorded observations of other notable species. Full methods are presented in Technical Appendix 9.2.

Bats

- 9.20 Consultants on behalf of RPS Group undertook surveys in summer 2020 to identify the bat species present on-site, assess their activity level, locate roosts at significant risk of disturbance, and assess the potential risk level to each species. Consultants from RPS Group completed activity surveys, comprising of the deployment of static recorders during the main bat activity season (May to September) covering the three critical activity periods: spring migration, maternity and autumn dispersal. Activity surveys followed NatureScot guidance 'Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation' (NatureScot, 2019). Full methods are presented in Technical Appendix 9.3.

Fish and Freshwater Pearl Mussel (FWPM) Habitat Assessment

- 9.21 GEL undertook fish and FWPM *Margaritifera margaritifera* habitat assessment along the Dalquhairn Burn, Auchengairn Burn and fish habitat utilisation along the unnamed watercourses within the Survey Area. The fish and FWPM habitat surveys were undertaken in July and October 2019 following the methods of Hendrey and Cragg-Hine (1997) and those developed for river/fish habitat surveying (Environment Agency, 2003 and Scottish Fisheries Co-Ordination Centre ((SFCC), 2007). Predominant habitat was recorded within specific stretches, and the habitat was defined following definitions adapted from the SFCC Habitat Manual (2007), Hendrey and Cragg-Hine (1997) and Maitland (2003). Habitat potential for FWPM was taken from the results of the above survey methods, adapted for FWPM habitat micro-preferences (Hastie *et al.* 2000).
- 9.22 Full methodology and results are presented in Technical Appendix 9.4.

Other Species

- 9.23 GEL did not complete formal surveys for reptiles or protected/notable invertebrate species as part of this assessment. However, incidental observations were recorded during all surveys for the presence of such species.

Assessment Methodology

- 9.24 The following section explains the criteria used to assess the importance of ecological receptors and the criteria used to predict the likely significant environmental effects on the identified receptors within the Survey Area during construction, operation and decommissioning of the Proposed Development.

Criteria for Evaluating Importance

- 9.25 Ecological receptors identified in the baseline surveys have been evaluated following CIEEM Best Practice Guidelines (2018). Ecological receptors identified as important were subject to detailed assessment. Receptors considered widespread and unthreatened by the Proposed Development were scoped out of any further evaluation within this chapter.
- 9.26 The importance of an ecological receptor can be due to a variety of reasons and are defined through legislation and policies. For example, importance can be as a result of

the quality or extent of designated habitats or areas, habitat or species rarity or the extent of the species range and/or decline.

- 9.27 Categories of geographical importance (from international to local level) which relate to ecological or nature conservation importance, together with examples and criteria of how to place a site - defined by its ecological attributes - are set out in EclA guidance. The evaluation of ecological features to a national or international importance level is relatively straight forward as guidance exists for the defining these exists; for example, Special Areas of Conservation (SAC) of Sites of Special Scientific Interest (SSSI). However, for identifying features at a regional or local level, criteria are not as easily defined. Where possible, the importance of ecological features identified within the Survey Area, have been defined by the geographical ranges in Table 9.3.

Table 9.3: Geographical Importance of Ecological Features

Geographical Importance	Definition
International	>1% of the European community species population/area of habitat extent. For example, internationally designated sites such as an SAC or a site meeting the criteria for international designations.
National (UK)	>1% of the United Kingdom species population/area of habitat extent. For example, a nationally designated site such as a SSSI or National Nature Reserve (NNR) or a site meeting the criteria for national designations.
Regional (Natural Heritage Zone or Local Authority Area)	>1% of the Natural heritage zone or species population/area of habitat extent. Sites which do not meet the criteria for SSSI selection but are of greater than the local criteria below.
Local	Within the local area of the Proposed Development For example, Local Nature Reserves (LNR). Areas of semi-natural ancient woodland smaller than 0.25 ha. Local Biodiversity Action Plan (LBAP) priorities, where they occur in sufficient abundance to maintain the local resource.

- 9.28 Assessing the level of importance of a site based on 1% of a population has no underlying biological basis; however, the value is commonly considered to provide appropriate levels of protections to species populations and habitat extents. The 1% value was adopted by the Ramsar Convention 1971 and has since gained acceptance on this basis.

- 9.29 The importance of ecological receptors can also be determined by the legislative status attached to each feature. Species of European (International) conservation importance are listed on Annex II, IV and V of the Habitats Directive. Species considered of principal importance for biodiversity in Scotland (the Scottish Biodiversity List) and listed under Part 1 section 2(4) of the Nature Conservation (Scotland) Act 2004. Other species are subject to a general level of legal protection through the Wildlife and Countryside Act 1981 (as amended) and also under the Council Directive 1992/43/EEC (1992) on the Conservation of Natural Habitats and of Wild Fauna and Flora (Habitats Directive). However, there is no clear guidance for conservation importance of ecological receptors other than those of European Protected Species and nationally designated site species and importance of these other species is based on professional judgement using the characteristics outlined above.
- 9.30 CIEEM guidance makes it clear that species appearing on national lists, i.e. Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) are not necessarily evaluated as nationally important by merely appearing on such lists. Evaluation importance should consider the number of individuals of a species within a geographic range, i.e. the number of a particular species likely to be affected by the Proposed Development and to what portion of the geographical range this constitutes.

Criteria for Evaluating Potential Impacts

- 9.31 An understanding of how ecological features will respond to the Proposed Development is required to determine the magnitude of any likely effects which may arise through construction or operation. It is only necessary to describe in detail the effects which are likely to be significant and impacts/effects which are unlikely to occur, or if they did happen would unlikely be significant, can be scoped out (CIEEM 2018).

Beneficial or Adverse Effects

- 9.32 Beneficial and adverse impacts and effects are determined whether the change is in accordance with nature conservation policy and objectives:
- Beneficial – a change which improved the quality of the environment, for example, increasing species diversity or extending/improving habitat extent. This can also include reducing the rate of existing environmental decline; and
 - Adverse – a change which results in the quality of the environment, for example, habitat destruction, habitat fragmentation, loss of species or pollution events.

Extent

- 9.33 The extent of an impact refers to the geographical area over which the impact may occur over typically representative conditions (CIEEM, 2018). For example, increased sediment run-off in watercourses.

Magnitude of Potential Effects

- 9.34 The magnitude of an impact refers to the size, intensity, or volume of and should be quantified where possible in absolute or relative terms. For example, exact areas of habitat

loss or percentage of species population decline (CIEEM, 2018). Table 9.4 defines the four levels of magnitude used in this assessment; these are generally considered to be adverse unless stated otherwise.

Table 9.4: Magnitude of Potential Effects

Level of Magnitude	Definition
Very High	Total or near loss of a population or habitat or due to disturbance, displacement, or species mortality Guide: >80% of the population/area affected.
High	A major reduction in a population or habitat or due to disturbance, displacement, or species mortality. Guide: 21-80% of the population/area affected.
Medium	A partial reduction in a population or habitat or due to disturbance, displacement, or species mortality. Guide: 6-20% of the population/area affected.
Low	A small (but apparent) reduction in a population or habitat or due to disturbance, displacement, or species mortality. Guide: 1-5% of the population/area affected.
Negligible	A very slight reduction in a population or habitat due to disturbance, displacement, or species mortality. Any reduction would be barely noticeable, equating to a 'no change' outcome. Guide: < 1% of the population/area affected.

Duration

9.35 CIEEM (2018) state that duration is defined in the relative context of ecological traits, such as the lifecycle of a species. The duration of an activity may differ from the duration of the resulting effect caused by the activity. Table 9.5 defines the timescales used within this assessment.

Table 9.5: Duration of Effects

Duration	Definition
Permanent	Effects continuing indefinitely beyond the span of one human generation (30+ years), except where there is likely to be substantial improvement after this period in which case the Long Term maybe more applicable.
Long term	Between 15 years up to (and including) 30 years.
Medium term	Between 5 years up to (but not including) 15 years.
Short term	Up to (but not including) 5 years.
Temporary	No effect.

Frequency and Timing

- 9.36 The resulting effect of an impact is influenced by the number of times an activity occurs (CIEEM, 2018). For example, a vehicle driving across sensitive habitat; one vehicle may have a slight impact but the habitat may recover, however, frequent vehicle passes will significantly degrade the habitat to the point where it may not recover and be permanently lost.

Reversibility

- 9.37 An impact from which recovery is not possible within a reasonable timescale or there is no chance of action to implement successful mitigation, the impact is classed as irreversible. An impact from which spontaneous recovery or with which recovery is possible through successful mitigation is classed as reversible. It should be noted that in some cases the same activity can cause impacts which are both irreversible and reversible (CIEEM, 2018).

Sensitivity Criteria

- 9.38 The sensitivity of an ecological receptor to a particular impact should also be considered as well as the zone of influence. Sensitivity criteria is variable across the taxonomic groups and behavioural sensitivity can also vary across individuals of the same species. Sensitivity can also be dependent on species' activity, for example, species are more likely to be susceptible to disturbance during the breeding season (CIEEM, 2018). As such, professional judgement is used when assigning sensitivity to an ecological receptor. Sensitivity is determined according to the species' behaviour, outlined using the criteria in Table 9.6.

Table 9.6: Levels of Sensitivity

Level of Sensitivity	Definition
High	Species in remote areas, away from human disturbance which would result in a long-lasting reaction to a disturbance event. Habitats which are considered to have a slow recovery time and could not re-establish quickly.
Medium	Species which are tolerant to human activity which result in a short-term reaction to a disturbance event. Habitats which are considered to have a moderate recovery time.
Low	Species which are regularly subject to human disturbance which result in a brief reaction to a disturbance event. Habitats which are considered to have a quick recovery time and could readily established.

Criteria for Evaluating Significance

- 9.39 The combination of Magnitude and Sensitivity can be applied to a significance matrix which categorises the impacts on an ecological receptor (Table 9.7). This approach takes on board the CIEEM (2018) guidance; however, it has been applied as it can help visualise levels of significance for a layperson. Professional judgement is also applied, using the criteria discussed above, to the individual ecological receptors identified to determine their sensitivity and significance within this assessment. Table 9.8 describes the significance

of each effect. Effects categorised as *moderate* or *major* significance are evaluated as *significant* under EIA Regulations, whilst those categorised as *minor* or *negligible* significance are evaluated as not significant.

Table 9.7: Significance Matrix

Magnitude	Value				
		Very high	High	Medium	Low
	Very high	Major	Major	Major	Moderate
	High	Major	Major	Major/Moderate	Minor
	Medium	Major	Major/Moderate	Minor	Negligible
	Low	Moderate	Minor	Minor	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible

Table 9.8: Significance Criteria

Significance Criteria	Definition
Major	Significant effect. The effect is likely to result in a permanent/long term and a highly significant effect on the integrity of the feature. Usually only applied to adverse effects.
Moderate	Significant effect. The effect is likely to result in a medium-term with a high/medium extent. These beneficial or adverse effects are considered to be critical factors and are likely to be material in the decision-making process.
Minor	No significant effect. Likely effect the feature at an insignificant level by virtue of its limited duration and/or extent, but there would probably be no effect on its integrity. May become a decision-making issue if leading to an increase in the overall adverse effect on a particular resource or receptor.
Negligible	Negligible effect. This is not a significant effect.

Baseline Conditions

Desk Study

Designated Sites

- 9.40 No designated sites were identified within The Site red line boundary. Two statutory designated sites were identified with ecologically qualifying features within a 10 km radius of The Site (Table 9.9). Sites designated for geological interest were excluded, and sites relating to ornithology are considered in Chapter 8: Ornithology.

Table 9.9: Designated Sites Within 10 km of The Site

Designated Site	Qualifying Features	Last Assessed Condition	Negative Pressures	Direction and distance from Study Area
Auchalton SSSI NatureScot Site Code: 96	Lowland neutral grassland	Unfavourable No change (9th July 2013)	Conservation activities, Invasive species, and Under grazing	3.5 km northeast of The Site.
Turnberry Dunes SSSI NatureScot Site Code:1571	Beetle assemblage	Favourable Maintained (26th June 2003)	Invasive species	8.5 km north-west of the additional section of the access track to the north of The Site.

- 9.41 The designated sites above are not considered to be impacted due to distance and due to no hydrological connectivity with the designated site and the Proposed Development. As such, the designated sites have been scoped out of any further assessment.

Protected Species

- 9.42 The ecological desk study was undertaken in 2019 and updated in 2020., addition of the access track and an additional section of off-site track to the north of the Proposed Development. Full results are presented in Technical Appendix 9.2.

Bat survey desk study

- 9.43 The desk study was undertaken in 2020. The South West Scotland Environmental Information Centre (SWSEIC) were contacted for records for all bat species within a 10 km buffer of The Site within the last ten years. Full details are provided in Technical Appendix 9.3.

Field Survey Results

Phase 1 Habitats

9.44 Full results of the Phase 1 Habitat Survey are presented in Technical Appendix 9.1 and Phase 1 habitat results are presented in Figure 9.2a-c. Table 9.10 below presents the Phase 1 habitats and areas within the Study Area. Table 9.13 presents a summary and evaluation of the habitats within the Survey Area.

Table 9.10: Phase 1 Habitat Areas

Phase 1 Code	Phase 1 Habitat	Area (ha)	Percentage (%)
A1.2.2	Coniferous plantation	696.84	63.21
E1.7	Wet modified bog	105.48	9.57
B5	Marshy grassland	68.91	6.25
B1.2	Semi-improved acid grassland	67.15	6.09
B4	Improved grassland	47.48	4.31
A4.2	Felled coniferous plantation	35.19(at time of survey)	3.19
E1.6.1	Blanket bog	32.09	2.91
A1.1.1	Semi-natural broadleaved woodland	21.19	1.92
C1.1	Continuous bracken	12.48	1.13
A1.1.2	Plantation broadleaved woodland	6.42	0.58
D6	Wet heath/acid grassland mosaic	6.13	0.56
C1.2	Scattered bracken	2.42	0.22
J3.6	Hardstand (road)	0.42	0.04
E2.1	Acid/neutral flush	0.13	0.01
Total		1102.33	100

9.45 No rare or red listed plant species were recorded during the vegetation surveys.

NVC Survey

9.46 Full results of the Phase 1 Habitat Survey are presented in Technical Appendix 9.1. A total of 26 habitats and habitat mosaics were identified during the NVC survey. Table 9.11 And Figure 9.3a-c presents the NVC habitats recorded across the Survey Area. Table 9.13 presents a summary and evaluation of the habitats within the Survey Area, including habitats of biodiversity value.

Table 9.11: NVC Habitat Areas

NVC Community	Area (ha)	Percentage (%)
PCW Plantation Coniferous woodland	696.84	63.21

NVC Community	Area (ha)	Percentage (%)
M25 <i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire	76.37	6.93
M15 <i>Scirpus cespitosus</i> – <i>Erica tetralix</i> wet heath	58.46	5.30
U4 <i>Festuca ovina</i> – <i>Agrostis capillaris</i> – <i>Galium saxatile</i> grassland	52.78	4.79
MG6 <i>Lolium perenne</i> – <i>Cynosurus cristatus</i> grassland	47.48	4.31
FPCW Felled plantation Coniferous woodland	35.19 (at time of survey)	3.19
M17 <i>Scirpus cespitosus</i> – <i>Eriophorum vaginatum</i> blanket mire	27.40	2.49
M15/M17 <i>Scirpus cespitosus</i> – <i>Eriophorum vaginatum</i> blanket mire/ <i>Scirpus cespitosus</i> – <i>Erica tetralix</i> wet heath mosaic	19.12	1.73
W7 <i>Alnus glutinosa</i> – <i>Fraxinus excelsior</i> – <i>Lysimachia nemorum</i> woodland	16.62	1.51
M23 <i>Juncus effusus</i> /acutiflorus– <i>Galium palustre</i> rush-pasture	11.48	1.04
U20 <i>Pteridium aquilinum</i> – <i>Galium saxatile</i> community	10.09	0.92
M25/U5 <i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire/ <i>Nardus stricta</i> – <i>Galium saxatile</i> grassland mosaic	7.19	0.65
U4/U20 <i>Festuca ovina</i> – <i>Agrostis capillaris</i> – <i>Galium saxatile</i> grassland/ <i>Pteridium aquilinum</i> – <i>Galium saxatile</i> community	6.99	0.63
W8 <i>Fraxinus excelsior</i> – <i>Acer campestre</i> – <i>Mercurialis perennis</i> woodland	6.20	0.56
M25/M17 <i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire/ <i>Scirpus cespitosus</i> – <i>Eriophorum vaginatum</i> blanket mire mosaic	5.87	0.53
M15/M25 <i>Scirpus cespitosus</i> – <i>Erica tetralix</i> wet heath/ <i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire mosaic	5.32	0.48
U20/U4 <i>Pteridium aquilinum</i> – <i>Galium saxatile</i> community/ <i>Festuca ovina</i> – <i>Agrostis capillaris</i> – <i>Galium saxatile</i> grassland mosaic	4.82	0.44
W17 <i>Quercus petraea</i> – <i>Betula pubescens</i> – <i>Dicranum majus</i> woodland	4.79	0.43
U5 <i>Nardus stricta</i> – <i>Galium saxatile</i> grassland	2.84	0.26
M18 <i>Erica tetralix</i> – <i>Sphagnum papillosum</i> raised and blanket mire	2.34	0.21
M17/M25 <i>Scirpus cespitosus</i> – <i>Eriophorum vaginatum</i> blanket mire/ <i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire mosaic	1.35	0.12
U4/M25 <i>Festuca ovina</i> – <i>Agrostis capillaris</i> – <i>Galium saxatile</i> grassland/ <i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire	0.93	0.08
U4/U5 <i>Festuca ovina</i> – <i>Agrostis capillaris</i> – <i>Galium saxatile</i> grassland/ <i>Nardus stricta</i> – <i>Galium saxatile</i> grassland mosaic	0.89	0.08
M25/U20 <i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire/ <i>Pteridium aquilinum</i> – <i>Galium saxatile</i> community mosaic	0.43	0.04
Hardstand	0.41	0.04
M4 <i>Carex rostrata</i> – <i>Sphagnum recurvum</i> mire	0.13	0.01
Total	1102.33	100

GWDTE Survey

9.47 Of the habitats recorded during the NVC survey, the following habitats were identified with a potential at 'high' level for dependency on a groundwater resource:

- M23 *Juncus effusus/acutiflorus*–*Galium palustre* rush-pasture
- W7 *Alnus glutinosa*–*Fraxinus excelsior*–*Lysimachia nemorum* woodland

The following habitats were identified with a potential at 'moderate' level for dependency on a groundwater resource:

- M15 *Scirpus cespitosus*–*Erica tetralix* wet heath
- M15 mosaics
- M25 *Molinia caerulea*–*Potentilla erecta* mire
- M25 mosaics

All other NVC communities were classed as Low. The percentage cover of potential GWDTE habitats is shown in Table 9.12. Potential GWDTE habitats are presented in Figures 9.4a-c.

Table 9.12: Potential GWDTE Cover

Potential GWDTE Dependency	Area (ha)	Percentage (%)
High	28.20	2.55
Moderate	174.22	15.80
Low	899.87	81.65
Totals	1102.33	100.00

9.48 Water chemistry analysis was undertaken at 30 locations across the Survey Area across moderate and high potential GWDTE habitats, and the results were compared against published field guidance (Sanders, 1988). Following analysis, it was determined that three areas of moderately dependent GWDTE were identified. One area of M15 identified to the south of the entrance track and two further areas of M25/M17 mosaics identified along the west boundary of the development area.

9.49 All other habitats were fed by telluric waters draining from upslope peat deposits, or by rain and surface waters. Full details of the GWDTE survey and assessment are presented in Technical Appendix 9.1. Actual GWDTE habitats are presented in Figures 9.5a & b.

Protected Species Survey (Excluding Bats)

9.50 Full details of the protected species survey are presented in Technical Appendix 9.2. And all protected species observations are presented in Figures 9.6a-d.

- 9.51 Several otter *Lutra lutra* spraints were recorded along the Ferly Burn during the field surveys which flows south along the east edge of The Site boundary. No evidence of holts or places of shelter were identified, and no otter signs were recorded along any of the other watercourses within the Survey Area. Otter spraint were also identified along the Ferly Burn during the Desk Study (Technical Appendix 9.2) and as such otter are therefore considered further in this assessment.
- 9.52 Badger *Meles meles* scat and runs in/out of the plantation were recorded along the east and southern plantation boundaries of the Survey Area. No further signs were identified. A disused outlier sett, old latrine and snuffle holes were identified along the additional access track Survey Area to the north of the main site. An active Badger sett was identified during the desk study, located out with the Survey Area. Badger are, therefore considered further in this assessment.
- 9.53 A frequently used pine marten *Martes martes* scatting area was identified along the forestry track within the coniferous plantation to the north of the Survey Area, and an individual scat was identified along the plantation edge to the south of the Survey Area. No further signs were recorded. Pine marten are therefore considered further in this assessment.
- 9.54 A large pond identified to the south of the Survey Area was assessed using a Habitat Suitability Index (HSI) for great crested newt *Triturus cristatus*. The output of the HSI calculations gave a score of 0.59, which classifies the pond as 'Below average' suitability following the Lee Brady system (Oldham, 2000). Based on this, and that no evidence of great crested newt was identified during the desk study, no further field survey was undertaken, and great crested newt are not considered further in this assessment.
- 9.55 No formal survey effort for other amphibians or reptile species was undertaken, however Incidental observations of Common frog *Rana temporaria*, common lizard *Zootoca vivipara* and a small female newt (unidentified sp.) were recorded incidentally during the protected species surveys. They are considered to be widespread and as such not significantly impacted by the Proposed Development and therefore these species have been scoped out of any further assessment but will be considered during pre-construction surveys.
- 9.56 Historical records for red squirrel *Sciurus vulgaris* and water vole *Arvicola amphibius* were identified during the desk study, within 5 km of the Survey Area; however, no evidence of either species was identified during the protected species surveys or recorded incidentally during any other survey. As such, both red squirrel and water vole are not considered further in this assessment.
- 9.57 Incidental observations and field signs of hare *Lepus sp.*, roe deer *Capreolus capreolus*, stoat *Mustela erminea*/weasel *Mustela nivalis*, field vole *Microtus agrestis*, bank vole *Myodes glareolus*, wood mouse *Apodemus sylvaticus* and hedgehog *Erinaceus europaeus* were recorded. These records were primarily recorded across the boundary and not centrally within the Survey Area are unlikely to be impacted. As such, these species are not considered further in this assessment.

Bat Survey

- 9.58 Full details of the bat survey are presented in Technical Appendix 9.3.
- 9.59 Habitat suitability of the Survey Area for bats was assessed as moderate potential for foraging and roosting bat following static detector surveys (Figure 9.7). The Survey Area is dominated by coniferous plantation; however, the watercourses present, such as the Auchengairn Burn provide good connectivity to the wider environment. No roost sites were identified within the Survey Area and the only potential roosting opportunity was recorded approximately 1 km south-east of the nearest turbine location.
- 9.60 Bat passes from eight bat species (common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *P. pygmaeus*, Nathusius' pipistrelle *P. nathusii*, Daubenton's *Myotis daubentonii*, Natterer's *M. nattereri*, Leisler's *Nyctalus leisleri*, noctule *N. noctula* and brown long-eared *Plecotus auritus* bats) were recorded. Assessment of bat activity using Ecobat (an online tool online freely available allowing comparison of activity levels found within the Survey Area and other sites within a given radius) classified the bat activity levels as moderate. As such bats are considered further within this assessment.

Fish and Freshwater Pearl Mussel Habitat Assessment

- 9.61 Full details of the fish habitat and FWPM survey are presented in Appendix 9.4.
- 9.62 The Survey Area offered varied suitability for salmonid species with some watercourses providing good flow types, instream and bankside cover, depths and variable substrates which would provide suitable habitat for fish. However, many sites were affected by known barriers to fish migration such as impassable falls further downstream within the catchment, with all but one survey location likely to be inaccessible to migratory fish.
- 9.63 There were few areas of suitable habitat for juvenile lamprey *Lampetra sp.* with most of the survey locations featuring coarser substrates, predominantly pebbles, cobbles, boulders or bedrock; however, there were areas of habitat where European eel *Anguilla Anguilla* FWPM may generally be found, in particular, large instream/bankside boulders or bankside crevices to utilise as cover.
- 9.64 Some isolated areas of habitat on the Dalquhairn Burn and the Auchengairn Burn were suitable for FWPM due to a combination of suitable depth and flow as well as patches of clean sand and gravel amongst some larger substrates; however, neither of the survey locations were classified as High for freshwater pearl mussel utilisation potential.
- 9.65 Habitat suitability for fish and FWPM overall is limited and confirmed two small, localised areas. Fish and FWPM assessments were not undertaken, however, given the connectivity of smaller watercourse to larger rivers with known salmonid and FWPM populations, there is still a risk of impact to these down-stream populations as a result of the Proposed Development. Fish and FWPM are therefore considered further within this assessment.

Evaluation of Sensitive Ecological Receptors

- 9.66 Table 9.13 provides an evaluation of the ecological receptors identified during the desk study and field surveys and rationale for scoping in/out of further assessment.

Table 9.13: Summary of Phase 1 and NVC Habitats

Habitat and area (ha)	GWDTE Potential	Conservation Status	Evaluation within Study Area	Importance
A1.2.2 -Coniferous plantation (PCW)	-	LBAP	Predominant habitat present within the Survey Area covering 63.21% of the Proposed Development. The habitat type of coniferous plantation is listed under the South Ayrshire LBAP as being abundant in South Ayrshire and not locally under threat. The habitat is considered to be of low conservation value as the dominant species coverage is non-native commercial tree species and supports limited biodiversity. There is potential for commercial coniferous plantation to adversely affect the wider ecosystem, e.g. increased acidification of water courses.	Less than local
E1.7 - Wet, modified bog (M15, M25 and mosaics)	Moderate	Annex 1 UKBAP SBL LBAP	The second most abundant habitat recorded within the Survey Area (10.72%). M15 and M25 and mosaics of both habitats found along the plantation boundaries and along the open ground to the west along the proposed access track. M15 is associated with modified bog occurring on deep peat (>0.5m), where peat draining and grazing have degraded the habitat. Modified bog capable of regeneration(M15) is considered to be an EC Annex 1; however, the extent and quality of the habitat is not significant to qualify as an Annex 1 habitat by definition. Purple moor grass pasture (M25) is listed as a UK BAP habitat but not on the local LBAP where it is listed as not locally under threat or important for key species. Moderate dependency GWDTE present under M25 mosaics along west Survey Area boundary.	Less than Regional
B5 - Marshy grassland (M23, M25 and mosaics)	M23 Moderate M25 High	SBL	Frequently recorded (6.25% of Survey Area), but not extensive mainly occurring along the plantation edge and along peat drains and primarily represented by M23 with occasional areas of M25 where it occurs on shallow peat (<0.5m). Not listed within the LBAP. M23 has moderate potential to be a GWDTE, however, all stands within the Survey Area are considered to be reliant on surface waters.	Less than local.

Habitat and area (ha)	GWDTE Potential	Conservation Status	Evaluation within Study Area	Importance
B1.2 - Semi-improved acid grassland (U4, U5 and mosaics)	-	-	U4 and U5 communities comprising 6.09% of the Survey Area along the edge of the coniferous plantation, often heavily grazed and species poor. Widespread locally and nationally and is not thought to contribute significantly to local biodiversity. Not listed as locally important on the LBAP	Less than local
B4 - Improved grassland (MG6)	-	-	Typically intensively managed for pastoral farming accounting for 4.31% of the Survey Area, present to the North of the main Proposed Development along a section of proposed access track. May provide some foraging habitat for species such as badger, however generally considered to be of low value to local biodiversity.	Less than local
A4.2 - Felled coniferous plantation (FPCW)	-	-	An area of felled plantation is located to the north-west of the representing 3.19% of Survey Area. Remaining brash may provide some habitat for pine marten but provides little else in the way of biodiversity potential.	Less than local
E1.6.1 - Blanket bog (M17, M18 and mosaics)	-	Annex 1 UKBAP SBL LBAP	Blanket bog was recorded in two main areas of the Survey Area, on the edge of the coniferous plantation. Listed as an EC Annex 1 habitat, UK BAP habitat, SBL and LBAP habitat, blanket bog is usually considered internationally important. However, the blanket bog on site is subject to modification from forestry drainage, anthropological peat drainage and overgrazing. Ayrshire LBAP estimates 31,329ha of blanket bog within Ayrshire, the extent recorded within the Survey Area accounts for 0.07% of the Local area.	Less than local
A1.1.1 - Semi-natural broadleaved woodland (W7, W8 & W17)	W7 High	UKBAP	Small areas along the edges of the plantation within the Proposed Development redline boundary. Larger areas present along the area of the additional access track to the north following riparian corridors, combined totalling 1.92% of the Survey Area. Wet woodland (W7 & W8) fall under UK BAP habitats and the LBAP. W7 is an EC Annex 1 habitat however riparian trees are excluded from the Annex 1 type. W7 is also a high potential GWDTE habitat; however, no evidence of a groundwater source was identified supplying these habitats.	Less than local

Habitat and area (ha)	GWDTE Potential	Conservation Status	Evaluation within Study Area	Importance
C1.1 & C1.2 - Continuous and scattered bracken (U20)	-	-	Found in patches across the perimeter of the plantation and in scattered fragments totalling 1.35% of the Survey Area. Species poor and supports limited biodiversity as well as negatively impacting other habitats through colonisation.	Less than local
A1.1.2 - Plantation broadleaved woodland (W7, W8)	-	-	New stands of broadleaved plantation present along the watercourse to the east of the Survey Area. Planted between 2019-2020 as part of Doughty Hill forestry scheme. W7, in this instance, is not considered to be a GWDTE in this instance due to being manually planted.	Less than local
D6 - Wet heath/acid grassland mosaic (M15)	Moderate	Annex 1	Wet heath/acid grassland mosaic only accounts for 0.56% of the habitats within the Survey Area. It would be considered as an EC Annex 1 habitat however, in the absence of grazing, heath would likely be more extensive, and as such, the condition and extent of the habitat is below that of international level. Estimated 25364ha of heath in Ayrshire, the 6.13ha surveyed accounts for 0.02% of this.	Less than Regional
Acid/neutral flush (M4)	-	UKBAP SBL	Two small individual areas of M4 were identified northeast of Doughty Hill long the edge of the plantation and only accounting for 0.01% of the total habitats recorded. Listed as a UK BAP habitat and SBL. Uncommon across the Survey Area, but Nationally widespread.	Less than local

Table 9.14: Summary of Protected Species

Species	Conservation/Legal Status	Evaluation within Study Area	Importance
Otter	European protected species (EPS) Wildlife and Countryside Act (WCA), SBL, LBAP	Scottish population estimate of 8000 individuals (NatureScot, 2020b). Several spraints identified along the Ferly Burn, along the Survey Area boundary. No places of shelter identified and no other field signs identified along other watercourses within the Survey Area.	Local
Badger	Protection of Badgers Act	Scat and runs identified in/out of plantation edge of the Survey Area. Disused outlier sett, old latrine and snuffle marks identified within the boundary of the north section of access track.	Local

Species	Conservation/Legal Status	Evaluation within Study Area	Importance
		Active sett identified from desk study, out with the Development Area buffer, east of the Survey Area. Widespread across mainland Scotland but not listed on SBL or LBAP.	
Pine marten	EPS, WCA, SBL	Regularly used scattling area identified along the forestry access track within the Survey Area to the north and an individual scatt along south plantation edge along the Survey Area boundary. Populations in Scotland are recovering but still considered to be rare, with a population estimate of 3700 adults (NatureScot, 2020c).	Local
Bats	EPS, SLB, (Common, & soprano pipistrelle & Noctule LBAP)	No roosts recorded within the Survey Area. The coniferous plantation is generally unsuitable for roosting bat species however plantation rides provide foraging corridors. Most of the activity was from common and soprano pipistrelle, both considered to be at high risk from turbine impact (NatureScot, 2018). Both Nyctalus species (Leisler's and Noctule bats) are high flying species and considered to be a high risk of turbine impact; however, low activity levels were recorded for these species.	Local
Fish	Salmon spawning beds protected under the Salmon and Freshwater Fisheries Act (SFF), SBL	Habitat suitability was assessed for the main watercourses across the Proposed Development. All but one watercourse was considered to have impassable barriers to fish. However, Atlantic salmon are known to be present in the Water of Girvan and the River Stinchar, both of which are hydrologically connected to the watercourses present within the Survey Area.	Local
FWPM	WCA	Considered to be rare in Scotland due to illegal pearl fishing and habitat damage. Habitat suitability was assessed across the Proposed Development with isolated areas of suitable habitat identified. Barriers to fish downstream are also likely to limit the likely presence of FWPM within the Proposed Development. Sensitive to water siltation and pollution. Historic evidence along the Water of Girvan from Cosgrove & Young (1998) suggest previous mussel results have been recorded incorrectly and that any pearl mussel records within this river system are false. Historic evidence along the River Stinchar previously known FWPM populations prior to 1997 are no longer present and that FWPM in this catchment are extinct.	Less than local

Cumulative Impacts

- 9.67 The impact of the Proposed Development should be assessed cumulatively with other Wind Farms within the local area. The cumulative impact can be hydrological, affecting aquatic receptors within the same catchments other developments or affecting terrestrial species as a result of construction or operation. Table 9.15 Lists other developments within 10 km of the Proposed Development which are considered as part of the cumulative assessment.

Table 9.15 Developments with potential cumulative impacts

Development	Status	Distance from the Proposed Development	No. Turbines
Hadyard Hill	Operational	Immediately adjacent to the west (c. 200m)	51
Carrick Wind Farm	Scoping	Immediately adjacent to the east (c.50 m)	Up to 17
Tralorg	Operational	c. 7 km south west	8
Dersalloch	Operational	c. 7.8 km north east	23
Assel Valley	Operational	c. 7.9 km west	10
Knockodhar	Scoping	c. 9.5 km south west	Up to 32

Future Site Baseline

- 9.68 The future baseline for The Site, presuming the area is left 'as is', is to assume grazing from sheep and deer would continue. Existing peat drains will continue to degrade further the existing wet modified bog habitats present around the Survey Area.
- 9.69 New plantation, across Doughty Hill and out with the Survey Area redline boundary would continue to develop and existing stands of coniferous plantation would continue to be managed as a commercial crop.

Assessment of Effects

- 9.70 Chapter 3: Project Description and Construction Methods details the infrastructure of the Proposed Development. This is used to assess the likely significant environmental effects as a result of the Proposed Development.

Embedded Mitigation

- 9.71 In response to the ecological features and potential constraints identified as part of the baseline surveys, the Proposed Development has undergone several design iterations. Chapter 4: Design Evolution provides details of each iteration.

General Good Practice

Mitigation Measures

- 9.72 A Construction Environmental Management Plan (CEMP) would be produced to detail good practice measures relating to all elements of construction. General good practice measures including general pollution prevention are detailed in Chapter 12: Hydrology, Hydrogeology and Geology. The CEMP would also detail measures undertaken to conduct best working practices in relation to working within peatlands as well as sediment management in relation to water crossings. Habitats will be retained where possible with a 'working footprint' clearly marked by temporary fencing/markers, allowing for reinstatement of habitats as soon as possible after any potential disruption.
- 9.73 The CEMP should detail a sufficient framework to be overseen by an Ecological Clerk of Works (ECoW).

Ecological Clerk of Works

- 9.74 To ensure the ecological features of The Site are preserved, a suitably qualified Ecological Clerk of Works should be employed over the course of the construction phase. The ECoW role would include:
- The provision of toolbox talks to all on-site staff so that employees are aware of the sensitive ecological features which may be impacted by certain construction activities and aware of the potential legal implications of non-compliance;
 - Undertake monitoring to ensure minimal damage to retained features;
 - Undertake pre-construction surveys and checks i.e. prior to vegetation clearance to minimise impacts to reptile species.

Pre-construction Surveys

- 9.75 There is likely to be a time lapse between the last baseline surveys and the commencement of construction. As such, there is the potential that the ecological conditions on-site could change. Pre-construction checks for otter, badger, pine marten and bat roosts should therefore be undertaken before construction begins.
- 9.76 Additionally, if the pre-construction surveys identify a change in the baseline condition, or if previously unrecorded protected species (red squirrel or water vole) are identified then relevant species licences should be obtained and mitigation drawn up.

General good practice in relation to Species

- 9.77 Mitigation will be required to comply with The Wildlife and Countryside Act 1981 (as amended in Scotland) to avoid the reckless killing or injury of an animal. It is considered that the Proposed Development will not impact reptiles and amphibians, and as such, it is considered that amphibian fencing or translocations will not be required. However, vegetation will be checked prior to clearance to remove any potential refugia which would encourage species to the area. Additionally, areas of ground can be pre-cut

(under ECoW supervision) to encourage the dispersal of reptile and amphibian species from an area.

- 9.78 All exposed excavations/pipework should be capped overnight, or access ramps installed to allow a means of escape for species such as otter or badger should they accidentally become trapped.

Likely Significant Effects

- 9.79 Potentially adverse environmental effects from the construction phase include habitat loss or degradation and as a result of loss of species, alterations to habitat composition as a result of a disruption to the existing hydrological connectivity of wetland habitats and pollution events (including chemical/fuel spillage, siltation of watercourses for construction of felling of plantation and light and noise pollution).
- 9.80 Potentially adverse effects from the operational phase are unlikely to impact habitats or species presence further. The main risk is to bat species collision with turbine blades.
- 9.81 Potentially adverse effects from decommissioning are considered to be similar to that of the construction phase; however, these are generally to be at a smaller scale and are therefore likely to be smaller in magnitude.

Construction Effects

Habitats

- 9.82 Permanent habitat loss is considered to be the total area of habitat lost as a result of direct displacement from site infrastructure construction.
- 9.83 Habitat loss was calculated by overlaying site infrastructure footprint over phase 1 habitats (Using GIS software) to calculate the areas displaced by the infrastructure (values also referenced from Chapter 13: Forestry). Table 9.16 details the areas of habitats permanently lost as a result of site infrastructure construction and remaining operational infrastructure.

Table 9.16: Approximate Habitat Area Lost as a result of Construction

Phase 1 Habitat	Area (ha)	Permanently Lost (ha)	Cause of Loss	Area remaining after loss (ha)	Loss of habitat (%)	Permanently lost + additional 10% area loss (ha)	Loss of habitat + 10% additional loss (%)
Coniferous plantation	696.84	53.10	Key-holing to make way for hardstand (tracks, crane pads, turbine foundations, borrow pits, substation, and construction compound)	643.74	7.62	58.41	8.38
Wet modified bog	105.48	0.81 (Assumed degraded after disturbance)	Access track	104.67	0.77	0.89	0.85
Marshy grassland	68.91	0.06	Access track	68.85	0.09	0.07	0.10
Semi-improved acid grassland	67.15	0.40	Access track	66.75	0.59	0.44	0.65
Improved grassland	47.48	-	-	-	-	-	0.00
Felled coniferous plantation	35.19	0.12 (habitat considered lost already)	-	35.07	0.33	0.13	0.36
Blanket bog	32.09	0.05	Turbine foundations, crane pad	32.04	0.16	0.06	0.17
Semi-natural broadleaved woodland	21.19	-	-	-	-	-	-
Continuous bracken	12.48	-	-	-	-	-	-
Plantation broadleaved woodland	6.42	0.04	Access track	6.38	0.62	0.044	0.69

Phase 1 Habitat	Area (ha)	Permanently Lost (ha)	Cause of Loss	Area remaining after loss (ha)	Loss of habitat (%)	Permanently lost + additional 10% area loss (ha)	Loss of habitat + 10% additional loss (%)
Wet heath/acid grassland mosaic	6.13	0.06	Access track	6.07	0.95	0.064	1.05
Scattered bracken	2.42	-	-	-	-	-	-
Hardstand (road)	0.42	-	-	-	-	-	-
Acid/neutral flush	0.13	-	-	-	-	-	-
Totals	1102.33	53.14	-	1047.69	4.96	60.10	5.45

- 9.84 Total direct habitat loss as a result of the Proposed Development is approximately 53.14 ha. This equates to approximately 4.96% of all habitats within the Survey Area (including habitats unaffected by infrastructure and excluding hardstand areas).
- 9.85 The total loss was calculated using the direct infrastructure footprint and no additional working area buffer was included. Taking a precautionary approach and adding an additional 10% loss to each habitat (to account for the working foot print of the construction phase) does not significantly impact the areas lost with all habitats (excluding Coniferous Plantation) exhibiting a loss of less than or equal to 1% of their respective total area. As such, it is assumed these areas are not significant in terms of the areas to be restored after the construction phase and are therefore grouped as permanently lost rather than a temporary loss.
- 9.86 There is potential for impacts to GWDTE as a result increased siltation and run-off. General pollution prevention and best practice for working in a wetland are presented in Chapter 12: Hydrology, Hydrogeology and Geology and will be followed to reduce the risk of an impact to GWDTE. All areas of moderate dependency habitat are located away from any hardstanding or infrastructure and as such it is not considered that there will be any significant impacts to GWDTE as a result of the construction Phase.
- 9.87 As such, the loss of habitats due to the construction phase is considered to be a minor, non-significant impact.

Otter

- 9.88 In the absence of mitigation, the loss of habitat within the Survey Area is unlikely to affect otter. Otter activity is most commonly associated with water courses (though will forage across terrestrial habitats at certain times of year) and all signs of the species were identified along the Survey Area boundary. Increased siltation of watercourses as a result of infrastructure construction may adversely affect the water courses utilised by otter, however not significantly due to the distance of water courses to the nearest proposed access track. Due to distance from proposed access track it is also considered that injury/death from construction traffic is unlikely. As such, it is considered that construction will have a minor impact leading to a low adverse non-significant effect on otter.

Badger

- 9.89 In the absence of mitigation, the loss of habitat within the Survey Area is unlikely to affect badger. No active setts were identified within the Survey Area, and deep peat soils within coniferous plantation are not considered optimal for sett construction, although several scats were identified along the existing plantation edge across Doughty Hill potentially indicating a clan territory boundary. An individual inactive outlier sett was identified along the proposed access track to the north of the main windfarm site; however, the proposed trackway is located over 200 m from the inactive sett. NaureScot advises a minimum construction buffer of 30 m and as such construction is unlikely to adversely affect badger. However, the increased construction traffic machinery may pose a traffic collision risk. As such, it is considered that construction would have a minor adverse impact leading to a minor, thus non-significant effect on badger.

Pine marten

- 9.90 In the absence of mitigation, the loss of habitat within the Survey area is likely to affect pine marten. Pine marten prefer native woodlands but will create dens in coniferous plantation and are known to avoid large areas of open ground, which would limit their range to the plantation on site. There is an estimated permanent loss of 53.10ha of coniferous plantation, with a temporary loss of 43.58 once plantation around turbines is restocked. The reduction of foraging habitat and habitat suitable for places of shelter is likely; however, no evidence of den sites was identified during the field surveys. Pre-construction surveys are proposed prior to the commencement of works, and if pine marten presence was recorded close to working areas, mitigation measures would be employed to avoid significant disturbance. Pine marten are known to be susceptible to disturbance from humans, and there is the potential for low levels of displacement as a result of construction activities. It is therefore considered that construction will have a minor adverse impact leading to a minor, non-significant effect on pine marten.

Bats

- 9.91 The coniferous plantation within the boundary of the Survey Area is sub-optimal for roosting bats, and no roosts were identified within the Survey Area boundary. The loss of plantation and open ground habitats is therefore not likely to have a negligible effect on bat roost potential.

- 9.92 The loss of habitat is likely to fragment the linear corridors created by plantation rides (in addition to creating new corridors) and edges which bats forage and commute along, and also reduce the tree canopy used by high flying *Nyctalus* species. The extent of habitat loss, however, is not significant and it is considered that construction during the bat activity season (dusk-dawn, April-October) will be during daylight hours. As such, construction activities are likely to have a negligible impact on foraging bat species, resulting in a minor, non-significant effect.

Fish

- 9.93 In the absence of mitigation, the construction phase has the potential to directly, and indirectly, have an adverse effect on fish species, particularly along the water crossings identified in Hydrology Technical Appendix 12.1. The mitigation presented in Chapter 12: Hydrology, Hydrogeology and Geology will aid in the mitigation of potential impacts arising from construction; however, there is still the potential that construction will adversely impact the watercourses and fish species downstream.
- 9.94 Felling and impacts arising from construction (including increased siltation from groundworks, increased erosion from drainage, changes to hydrological connectivity or accidental pollution) all have the potential to impact fish populations adversely. These are likely to be localised (particularly at water crossing points) impacts, and as such, due to dissipation with increased distance from impact source, the potential impacts to fish will decrease with distance.
- 9.95 Due to the areas of plantation required to be felled during the construction phase, there is the risk of increased acidification of the watercourses. However, mitigation should be embedded by the avoidance of working within or near watercourses (a 50 m minimum buffer is recommended, See Chapter 12: Hydrology, Hydrogeology and Geology) and as such this is predicted to have a minor adverse impact on fish species resulting in a minor non-significant effect.

Cumulative Construction Impact

- 9.96 Hadyard Hill is immediately adjacent to the Proposed Development and has been operational since 2006, as such it is not thought that the operation of Hadyard Hill will contribute to the potential impacts to the aquatic environment during the construction, operation or decommissioning of the Proposed Development. Tralorg, Dersalloch and Assel Valley windfarms are also operational and it is considered that due to distance from the site (>7 km) there will be no cumulative constructional impacts.
- 9.97 The Carrick Windfarm scoping report (SPR, 2020) identifies that the site is hydrologically connected to both the Water of Girvan and the River Stinchar. Should the Carrick Windfarm be constructed at the same time as the Proposed Development there is the potential that this would contribute to the cumulative impact of the Proposed Development construction phase. Further details of hydrological cumulative impacts are presented in Chapter 12.

Mitigation, Compensation and Enhancement

- 9.98 General good practice and embedded mitigation is included in section 9.72-9.79 however, no further mitigation is proposed for the construction phase as no significant environmental effects are predicted. However, a Habitat Management Plan (HMP) and Species Protection Plan (SPP) would be produced which would detail further mitigation, compensation and enhancement measures which would be implemented in order to counteract residual effects of habitat loss or species loss which may arise from the construction phase.
- 9.99 The temporary coniferous plantation lost during construction will be restocked along trackways and around turbine hardstand, up to 100 m from the turbine base once construction works are complete.
- 9.100 To account for the loss of modified bog habitats, the HMP should outline areas where degraded bog could have peat drains blocked in order to raise the water table and restore the bog back to blanket bog condition. Due to the small areas lost during construction, and habitat available for improved management, the restoration of bog habitats across The Site has the potential to result in a minor beneficial impact.
- 9.101 Assuming best practice and mitigation is followed, no notable residual effects are expected on the ecological features present.

Operational Effects

- 9.102 It is assumed that any maintenance which would require construction activities at the Proposed Development will follow best practice and guidance from the CEMP and be treated as if this was still under the construction phase.

Habitats

- 9.103 Once the infrastructure is in place, it is not thought that any further habitat loss would be experienced. The use of service vehicles across the Site has the potential for fuel spills/pollution events; however, the frequency of this is likely to be very low, and the implementation of best practice (i.e. all vehicles must contain spill kits) would result in a negligible impact on habitats during construction leading to a minor, non-significant effect.

Otter

- 9.104 It is not though the operational phase will adversely impact otter. Due to distance of turbines to habitats suitable to support otter, noise from turbines is considered to be of low magnitude. Operation will be near continuous and as such, there is potential for habituation to the presence and noise of turbines. Otter occupy large ranges and can easily move away from areas of disturbance, prior to habituation. No places of shelter were identified during surveys and as such any initial displacement is only likely to temporarily impact foraging activity at a low level. As such operation is likely to have a minor- significant effect on otter.

Badger

- 9.105 It is not thought the operational phase will adversely impact badger. Due to the distance of turbines to habitats suitable to support otter, noise from turbines is considered to be of low magnitude. The operational phase will be near-continuous, and as such, badger are likely to habituate to the presence and noise of turbines. Badger occupy large ranges and can easily move away from areas of disturbance, prior to habituation. No active sets were identified within The Site during surveys and as such initial displacement is only likely to temporarily impact foraging activity at a low level. As such operation is likely to have a minor non-significant effect on badger.

Pine marten

- 9.106 It is not thought the operational phase will adversely impact pine marten. Operation of the Proposed Development will be near-continuous and as such, pine marten are most likely to habituate to the presence and noise of turbines. However, human disturbance from site maintenance is likely, though this will primarily be limited to infrastructure areas (trackways and turbine hardstand). Minimal site vehicle activity is expected, and the implementation of speed limits would remain from the best practice of the construction phase. As such, the operation is likely to have a minor non-significant impact on pine marten.

Bats

- 9.107 The operational effect on bat species is likely to be from a direct collision with turbine blades or as a result of barotrauma (injury/death caused by the change in air pressure in the wake of rotating turbine blades).
- 9.108 The assessment of bat activity follows NatureScot (2019) guidance and uses the analysis tool, Ecobat (Mammal Society, 2020). Information on bat activity from static detector surveys is entered into Ecobat and assessed against information collected from similar areas at the same time of year and in similar weather conditions. A percentage rank for activity, for each night of detector deployment, is then provided, allowing a comparison of data across other sites in Britain.
- 9.109 The full analysis of bat activity and Ecobat output is presented in Technical Appendix 9.3.
- 9.110 Ecobat output classifies the Proposed Development as having a moderate risk to bats with common and soprano pipistrelle and *Nyctalus sp.* (Leisler's and noctule). All other species recorded were considered to be at low risk from the Proposed Development. In the absence of mitigation during the operational phase, this is likely to result in a moderate, significant impact on bats.

Fish

- 9.111 It is not thought that potentially hazardous materials will need to be stored within the Proposed Development once construction is complete, however, if this is needed due to maintenance requiring a construction element, standard pollution control measures and safe storage of materials would be implemented. As such, there is likely to be a minor non-significant effect on watercourses and wetland habitats.

Operational Phase Cumulative Impact

- 9.112 It is not known if the operation of Hadyard Hill has resulted in bat strikes. Similarly, information is not available on bat collisions at Tralorg, Dersalloch or Assel Valley. On a precautionary basis, there is potential for increased collision risk to bat species as a result of the operational phase of the Proposed Development.
- 9.113 Once operational, there is the potential for increased bat collision risk between Hadyard Hill, the Proposed Development and Carrick Wind Farm (if consented) and Tralorg, Dersalloch and Assel Valley.

Mitigation, Compensation and Enhancement

- 9.114 To reduce the potentially significant environmental impacts to bat species, mitigation will need to be implemented during the operational phase.
- 9.115 Following NatureScot (2019) guidance initial mitigation should include moving turbine positions. Micro-siting of up to 100 m is expected, however, due to the nature of the keyholing required on-site, corridors will still be required to cut through the plantation, maintaining linear foraging corridors. Therefore, moving of turbines is not likely to reduce the potential impact to bat species.
- 9.116 It is considered in Britain that most bat activity is within close proximity to habitat features and as such a minimum buffer of 50 m between the turbine blade tip and the edge of nearby woodland features is recommended. The precise buffer distance can be calculated using a set formula detailed in Technical Appendix 9.3. Following turbine specification detailed in Chapter 3: Project Description and Construction Methods (blade length of 76.5 m, and nacelle height of 122.5 m) and assuming an average plantation height of 20m, turbines with a blade tip height of 200 m will require a buffer of 74.1m from the turbine base.
- 9.117 It is assumed the key-holing of plantation around turbines will be 100m from the turbine base (Chapter 3: Project Description and Construction Methods), and as such, this exceeds the minimum distance required to reduce the potential operational impacts. It should be noted however that following tree felling, it is likely there would be an increase in suitable foraging habitat for hen harrier within The Site (See Chapter 8: Ornithology).
- 9.118 The implementation of a buffer between turbines and woodland edges will reduce impacts on pipistrelle species, however *Nyctalus* species, which are high flying (above canopy height) are still likely to be at collision risk and further mitigation will be required to reduce potential impacts.
- 9.119 NatureScot (2019) guidance suggests 'feathering' – pitching the blades out of the wind – to below 2rpm while idling, and in increasing the cut-in speed during 'high-risk periods' (dusk-dawn, April-October) can reduce bat mortality on windfarm by up to 50%. The option of 'feathering' does not result in loss of output from the turbine and is recommended as best practice wherever possible.

- 9.120 It is thought that a combination of a sufficient buffer from blade tip to habitat edge and a reduction in rotation speed while idle will sufficiently reduce the risk of injury or mortality to all bat species across the Proposed Development.
- 9.121 Post-construction monitoring of bat activity around turbines and dog searches for the presence of bat corpses (caused through collision or barotrauma) should be undertaken during the first two years of the operational phase, across high-risk periods of activity. In the unlikely event that mortality is recorded, further activities should be implemented to reduce the risk of mortality, such as increasing buffer distances.
- 9.122 It is not thought that any additional mitigation measures will be required during the operational phase. The HMP and SPP should detail post-construction monitoring to ensure the conditions on-site remain the same and that adverse impacts do not result over time as a result of the Proposed Development. As well as additional enhancement measures to be implemented to provide a net biodiversity gain.

Residual operational effects

- 9.123 No significant effects on bat species are expected following the implementation of mitigation.
- 9.124 No other effects are expected on other ecological receptors as a result of the operational phase.

Decommissioning Effects

- 9.125 It is considering that the effects of decommissioning will follow that of the construction effects and as such, no significant impacts are predicted.

Further Survey and Monitoring requirements

- 9.126 As requested by the Ayrshire Rivers Trust, pre and post-construction survey and monitoring for fish and invertebrate species would be undertaken. Details of the survey would be provided in a detailed Fish Monitoring Plan (FMP) to be agreed in consultation with the Rivers Trust.

Summary of Predicted Effects

- 9.127 A summary of likely significant effects on important ecological features is provided in Table 9.17

Table 9.17: Summary of Effects

Predicted Effect	Good practice measures	Significance	Additional Compensation/ Mitigation	Residual significance
Construction Phase				
Permanent loss of coniferous plantation (103.58)	Hydrological mitigation measures.	Not significance	None	Not significant
Temporary loss of habitats including wet modified bog (0.81ha)	Hydrological mitigation measures and clearly defined working area to minimise the unnecessary effect.	Not significance	Restoration of wet modified bog to increase net biodiversity	Not significant
Potential disturbance to GWDTE habitats	Hydrological mitigation measures and clearly defined working area to minimise the unnecessary effect.	Not Significant	Follow CEMP guidance	Not significant
Unintentional disturbance/injury/death of otter, badger and pine marten	Pre-construction surveys, Cover excavations and limit vehicle speed on-site.	Not significant	Creation of HMP and for mitigation	Not significant
Impacts to water quality from run-off (impacting fish populations)	Hydrological mitigation measures	Not significant	Creation of CEMP and HMP and for mitigation	Not significant
Unintentional injury/death of reptile species	Remove hibernacula features, pre-cut areas to encourage dispersal (overseen by an ECoW)	Not significant	None	
Operational Phase				
Unintentional disturbance/injury/death of otter, badger and pine marten	Maintain on-site speed limits, follow good practice guidelines for potential construction maintenance works,	Not significant	Follow post-construction monitoring as detailed in HMP/SPP to ensure on-site conditions do not deteriorate over time.	Not significant
Bats – turbine collision/barotrauma	Post-construction monitoring. 'Feathering' of rotors.	Not predicted to be significant for pipistrelle sp.	Implement 50 m minimum buffer from blade tip to habitat edge.	Not significant for all bat species

Predicted Effect	Good practice measures	Significance	Additional Compensation/ Mitigation	Residual significance
		Significant for <i>Nyctalus</i> sp.		
Damage to watercourses from pollution events	Hydrological mitigation measures. Maintain a buffer of 20 m from watercourses, store any on-site materials appropriately.	Not significant	None	Not significant

Statement of Significance

- 9.128 Following the implementation of good practice, embedded mitigation and detailed mitigation to mitigate the risk of potential collision of bat species with turbine blades, no significant environmental effects are predicted as a result of the Proposed Development alone or in combination with other nearby developments.

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