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Cairn Duhie Wind Farm
National Vegetation Classification & Habitats Survey

Appendix 7.1

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EXECUTIVE SUMMARY

MacArthur Green was commissioned by RES (the 'Applicant') to conduct and report on National Vegetation Classification (NVC) and habitat surveys at the proposed Cairn Duhie Wind Farm by Ferness, Highland (hereafter referred to as the 'Proposed Development').

The aim of the NVC survey is to identify and map the vegetation communities present within the site in order to identify those areas of greatest ecological interest (i.e. EU Habitats Directive Annex I habitats; potential Groundwater Dependent Terrestrial Ecosystems (GWDTE), and Scottish Biodiversity List (SBL) priority habitats). This information is used to inform the wind farm design process and the ecological assessment for the Cairn Duhie Wind Farm Environmental Impact Assessment (EIA) Report.

Surveys were conducted on 2nd to 4th December 2019 by MacArthur Green. Previous surveys of the site were also undertaken on 19th and 20th June 2012 for the Consented Development. Given the time since the original surveys were undertaken, the 2019 surveys were conducted to verify, update and amend mapping boundaries and habitat classifications where necessary. In total 21 NVC communities were recorded at the site along with various associated sub-communities, however only a small number of communities accounted for the majority of the site area.

The most common and widespread communities, covering much of the landscape, are M15 *Trichophorum germanicum – Erica tetralix* wet heath and M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire. To a lesser extent, M17 *Trichophorum germanicum – Eriophorum vaginatum* blanket mire and M20 *Eriophorum vaginatum* blanket mire also form part of the blanket bog habitat, along with a number of other less well represented and largely fragmentary mire communities and which also contain a number of flushed communities.

A number of calcifugous and mesotrophic grasslands cover smaller areas of the site on thinner peats and shallow acid to neutral base-poor mineral soils. The most common acidic grassland within the site is the U4 *Festuca ovina – Agrostis capillaris – Galium saxatile* grassland, followed by U5 *Nardus stricta – Galium saxatile* grassland and U6 *Juncus squarrosus - Festuca ovina* grassland. Damp neutral soils on site are generally characterised by the MG10 *Holcus lanatus – Juncus effusus* rush-pasture and occasionally M23 *Juncus effusus/acutiflorus – Galium palustre* rush-pasture. These communities also form mosaics.

The NVC surveys have also revealed the presence of a number of potential GWDTE habitats, as well as Annex I and Scottish Biodiversity List Priority Habitats.

1 INTRODUCTION

MacArthur Green was commissioned by RES (the 'Applicant') to carry out a National Vegetation Classification (NVC) and habitats survey at the Cairn Duhie Wind Farm, near Ferness, approximately 15km south-east of Nairn (hereafter referred to as the 'Proposed Development').

The aim of the NVC survey is to identify and map the vegetation communities present within the site in order to identify those areas of greatest ecological interest (i.e. EU Annex I habitats[1]; potential Groundwater Dependent Terrestrial Ecosystems (GWDTE); and Scottish Biodiversity List (SBL) priority habitats). This information is used to inform the wind farm design process and the ecological assessment for the Cairn Duhie Wind Farm Environmental Impact Assessment (EIA) Report.

This report details the findings of the NVC surveys together with an evaluation of those communities described.

2 THE SITE AND STUDY AREA

The Proposed Development site ('the site') is situated approximately 2km south-east of Ferness and approximately 15km south-east of Nairn, extending to approximately 663.65 hectares (ha). The Proposed Development is located on the site of the consented Cairn Duhie Wind Farm (hereinafter referred to as the 'Consented Development') which was approved in 2017. The Proposed Development is a re-design of the Consented Development.

The site is bounded to the west by the A939 road and the B9007 to the north and follows the Moray Council local authority boundary to the east. The site is within the administrative boundary of The Highland Council (THC).

The landform of the site is characteristic of the wider landscape, comprising open upland with a mixture of land cover, including bog and heath habitats with localised wooded areas and scattered mature trees, with coniferous plantations occupying areas to the north. In addition, 275 kilovolt (kV) overhead transmission lines mounted on steel towers traverse the northern part of the site to the west. Contained within the site is the low conical hill of Cairn Duhie, marking the highest point (at 312m Above Ordnance Datum (AOD)). Land gently slopes down from this point in all directions, reaching the lowest point to the north of the site (200m AOD). The site is enclosed by higher topography to the south and east by the Hill of Aitnoch (413m AOD) and the Knock of Braemoray (456m AOD) respectively.

There are several minor watercourses located within the site, including evidence of systematic drainage channels, as well as the Burn of Lochantùtach, which drains the southern extents of the site and is a tributary of the Dorback Burn which flows perpendicular to the east of the site. The northern part of the site is drained by the Stripe of Muckle Lyne and the Stripe of Little Lyne, which both drain northwards into the River Findhorn. To the south of the site lies Lochan Tùtach.

There are no statutory designations with ecological features within the site. There are two Special Area of Conservation (SACs) and two Sites of Special Scientific Interest (SSSIs) within 5km of the site that contain

[1] As defined by the Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora – the 'Habitats Directive'.

botanical or habitat related features. The relevant qualifying interests for these designations are detailed in Table 2-1; see also Figure 7.1.

Table 2-1 Designated sites with botanical qualifying features within 5km of the site

Designated Site	Distance from site (km)	Qualifying Interests	Last Assessed Condition & Date
Lower Findhorn Woods SAC	2.8km from site boundary to the north	Mixed woodland on base-rich soils associated with rocky slopes	Unfavourable Declining 24/09/2012
Lower Findhorn Woods SSSI	2.8km from site boundary to the north	Bryophyte assemblage and lichen assemblage	Favourable Maintained (Bryophyte assemblage), 19/09/2010 Unfavourable No Change (Lichen assemblage), 17/09/2009
Moidach More SAC	3.5km from site boundary to the east	Blanket Bog	Unfavourable Recovering 24/09/2008
Moidach More SSSI	3.5km from site boundary to the east	Blanket Bog	Unfavourable Recovering 24/09/2008

The Carbon and Peatland map[2] was consulted to determine likely peatland classes present within the site. The map provides an indication of the likely presence of peat at a coarse scale. The Carbon and Peatland map has been developed as "*a high-level planning tool to promote consistency and clarity in the preparation of spatial frameworks by planning authorities*"[3]. It identifies areas of "*nationally important carbon-rich soils, deep peat and priority peatland habitat*" as Class 1 and Class 2 peatlands. Class 1 peatlands are also "*likely to be of high conservation value*" and Class 2 "*of potentially high conservation value and restoration potential*".

Figure 7.2 indicates that, according to this map, the site is partially underlain by Class 1 peatland, and with just a small area of Class 2 peatland in the north-east. The remainder of the site is made up of Class 3, Class 4, and Class 5 soils. As the Carbon and Peatland map is a high-level tool, detailed habitat surveys have also been carried out across the site to inform the site assessment on peatland and associated habitats, which is required to identify actual effects of the proposal; including siting, design and mitigation. The results of the habitat surveys are discussed below in Section 5.2.

The 'study area' in which NVC and habitat surveys were undertaken covered the entirety of the site area. The study area therefore covered an area of 663.65 ha, as per Figure 7.3.

3 METHODOLOGY

3.1 National Vegetation Classification (NVC)

The vegetation was surveyed by suitably qualified and experienced botanical surveyors using the NVC scheme (Rodwell, 1991-2000; 5 volumes) and in accordance with NVC survey guidelines (Rodwell, 2006). The NVC scheme provides a standardised system for classifying and mapping semi-natural habitats and ensures that surveys are carried out to a consistent level of detail and accuracy.

Homogeneous stands and mosaics of vegetation were identified and mapped by eye and drawn as polygons on high resolution aerial imagery field maps. These polygons were surveyed qualitatively to record dominant and constant species, sub-dominant species and other notable species present. The surveyors worked progressively across the study area to ensure that no areas were missed, and that mapping was accurate. NVC communities were attributed to the mapped polygons using surveyor experience and matching field data against published floristic tables (Rodwell, 1991-2000). Stands were classified to sub-community level where possible, although in many cases the vegetation was mapped to community level only because the vegetation was too species-poor or patches were too small to allow meaningful sub-community determination; or because some areas exhibited features or fine-scale patterns of two or more sub-communities.

Quadrat sampling was not used in this survey because experienced NVC surveyors do not necessarily need to record quadrats in order to reliably identify NVC communities and sub-communities (Rodwell, 2006). Notes were made about the structure and flora of larger areas of vegetation in many places (such as the abundance and frequency of species, and in some cases condition and evident anthropogenic impacts). It can be better to record several larger scale qualitative samples than one or two smaller quantitative samples; furthermore, qualitative information from several sample locations can be vital for understanding the dynamics and trends in local (study area) vegetation patterns (Rodwell, 2006).

Due to small scale vegetation and habitat variability and numerous zones of habitat transitional between similar NVC communities, many polygons can represent complex mosaics of two or more NVC communities. Where polygons have been mapped as mosaics an approximate percentage cover of each NVC community within the polygon is given so that the dominant community and character of the vegetation could still be ascertained.

3.2 Phase 1 Habitat Characterisation

The NVC and mapping data was also correlated to their equivalent habitats according to the Phase 1 habitat classification (JNCC, 2010), considering the species composition and habitat quality. The Phase 1 characterisation has been utilised to allow a broader visual representation of the habitats within the study area. Polygons or areas where there are mosaic NVC communities have generally been assigned a single Phase 1 classification where possible based on the dominant NVC type (despite some polygons containing multiple Phase 1 types, often in low percentages). Therefore, the Phase 1 characterisation is generally a broader overview, and the NVC data should be referred to for further detail in any specific area.

[2] https://www.nature.scot/professional-advice/planning-and-development/general-advice-planners-and-developers/planning-and-development-soils/carbon-and-peatland-2016-map.

[3] https://www.nature.scot/professional-advice/planning-and-development/general-advice-planners-and-developers/planning-and-development-soils/carbon-and-peatland-2016-map.

Botanical nomenclature in this report follows that of Stace (2019) for vascular plants, Atherton *et al.* (2010) for bryophytes and Purvis *et al.* (1992) for lichens.

4 SURVEY DETAILS & LIMITATIONS

Surveys were undertaken from 2nd to 4th December 2019 inclusive, and were therefore undertaken outwith the optimal survey period for habitat surveys. Due to the main purpose of the surveys being to verify existing data, update and amend mapping boundaries and habitat classifications (if required) from the previous surveys in June 2012 (i.e. the optimal survey period) for the Consented Development, this constraint was considered not to affect the validity of the survey results, or the robustness of any assessments made from these data, as detailed below. Furthermore, given the types of habitats present on the site, these are still readily identifiable in winter due to the nature of the vegetation.

The NVC system does not cover all possible semi-natural vegetation or habitat types that may be found. Since the NVC was adopted for use in Britain in the 1980's further survey work and an increased knowledge of vegetation communities has led to additional communities being described that do not fall within the NVC system. Where such communities are found and recorded, they are given a non-NVC community code and are described.

It should be noted that the results from this survey, and the matches made in describing communities, represent a current community evaluation at the time of survey (as opposed to one seeking to describe what the community was before any human interference, or what it might become in the future). In light of this, a clear constraint of the vegetation survey and evaluation process as used in this and other surveys is that it offers only a snapshot of the vegetation communities present and should not be interpreted as a static long-term reference.

Ecological surveys are limited by factors which affect the presence of plants such as the time of year and weather. The ecological surveys undertaken to support the Proposed Development have not therefore produced a complete list of plants and the absence of evidence of any particular species should not be taken as conclusive proof that the species is not present or that it will not be present in the future. However, the results of these surveys have been reviewed and are considered to be sufficient to undertake the assessment.

5 RESULTS

5.1 Summary of Habitat Types & NVC Communities

Twenty-one NVC communities and two non-NVC communities were recorded within the study area, and these corresponded to 15 Phase 1 habitat types. These communities and habitat types, and their respective site-specific correlations are summarised below in Table 5-1.

Table 5-1 Phase 1 habitat type equivalents of NVC communities and other habitats recorded

Phase 1 Habitats	NVC Communities & Other Non-NVC Habitats/Features Recorded
A1.1.1 Broadleaved Semi-Natural Woodland	W4 *Betula pubescens – Molinia caerulea* woodland
A1.2.2 Coniferous Plantation Woodland	W18 *Pinus sylvestris – Hylocomium splendens* woodland CP Coniferous Plantation (non-NVC type)
A2.1 Scrub –Continuous	W23 *Ulex europaeus – Rubus fruticosus* scrub
B1.1/B1.2 Unimproved & Semi-Improved Acid Grassland	U4 *Festuca ovina – Agrostis capillaris – Galium saxatile* grassland U5 *Nardus stricta – Galium saxatile* grassland U6 *Juncus squarrosus – Festuca ovina* grassland
B5 Marsh/Marshy Grassland	MG10 *Holcus lanatus – Juncus effusus* rush-pasture M23 *Juncus effusus/acutiflorus – Galium palustre* rush-pasture
D1.1 Dry Dwarf Shrub Heath - Acid	H9 *Calluna vulgaris – Deschampsia flexuosa* heath H10 *Calluna vulgaris – Erica cinerea* heath H12 *Calluna vulgaris – Vaccinium myrtillus* heath
D2 Wet Dwarf Shrub Heath	M15 *Trichophorum germanicum – Erica tetralix* wet heath
D5 Dry Heath/Acid Grassland Mosaic	Mosaics of D1 and B1 communities
D6 Wet Heath/Acid Grassland Mosaic	Mosaics of D2 and B1 communities
E1.6.1 Blanket Bog	M2 *Sphagnum cuspidatum/fallax* bog pool community M3 *Eriophorum angustifolium* bog pool community M17 *Trichophorum germanicum – Eriophorum vaginatum* blanket mire M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire M20 *Eriophorum vaginatum* blanket mire
E1.7 Wet Modified Bog	M25 *Molinia caerulea – Potentilla erecta* mire *Erica tetralix* sub-community
E2.1 Acid/Neutral Flush/Spring	M6 *Carex echinata - Sphagnum fallax/denticulatum* mire
E3.2 Fen – Basin Mire	M4 *Carex rostrata - Sphagnum fallax* mire
F1 Swamp	S9 *Carex rostrata* swamp
G1 Open Water	SW Standing Water (non-NVC type)

The following sections describe each of these Phase 1 habitat types and the communities underpinning these within the study area. Habitats are described in the order they appear within the Phase 1 classification. The survey results are displayed in Figure 7.3 which combines Phase 1 symbology with NVC data.

A number of target notes (TNs) were also made during surveys, often to pinpoint areas or species of special interest. These target notes are shown in Figure 7.3 and detailed within Annex A; target note photographs are included within Annex B. Further photographs of a number of the typical habitat types found within the study area are provided within Annex C.

5.2 Woodland & Scrub

5.2.1 A1.1.1 Broadleaved Semi-Natural Woodland

Broadleaved semi-natural woodland is present as small scattered patches and fragments along the western boundary of the study area.

The canopy is often composed of well established, mature, broadleaved tree species. This habitat contains the NVC community W4 *Betula pubescens – Molinia caerulea* woodland (see Annex C, Photo C-3), with the majority of the woodland being recorded as the W4c *Sphagnum* sub-community. The canopy was dominated with *Betula* sp. with a field layer dominated by *Molinia caerulea* with occasional *Eriophorum vaginatum*. The wetter areas being dominated with an extensive bryophyte cover consisting of *Sphagnum capillifolium* and *S. fallax*.

5.2.2 A1.2.2 Coniferous Plantation Woodland

Coniferous plantation woodland is made up of four woodland blocks located within the very north of the study area, with two of the stands containing semi-mature *Pinus sylvestris* and the remaining two containing *Picea sitchensis*. The stands of *Pinus sylvestris*, although plantation in origin, were recorded as the W18 *Pinus sylvestris – Hylocomium splendens* woodland NVC community, specifically the W18a *Erica cinerea – Goodyera repens* sub-community. The areas of *Picea sitchensis* were recorded as the non-NVC community conifer plantation (CP) which is not represented within the NVC. These areas were all recorded as mature plantation woodland.

5.2.3 A2.1 Dense/Continuous Scrub

Some small areas of dense/continuous scrub were recorded in the north of the study area. All areas were of the W23 *Ulex europaeus – Rubus fruticosus* scrub community. The W23 community here appears as homogenous stands of *Ulex europaeus* with the exception of one area where the community forms part of a mosaic with other woodland and mire communities.

5.3 Grasslands & Marsh

5.3.1 B1.1/B1.2 Unimproved & Semi-Improved Acid Grassland

Unimproved and semi-improved acid grassland is concentrated to the north of the study area. In one location this habitat was recorded within a mosaic with the blanket bog habitat (see Section 5.5.1 below). This habitat type is predominately made up of U4 *Festuca ovina – Agrostis capillaris – Galium saxatile* grassland, although the communities U5 *Nardus stricta – Galium saxatile* grassland and U6 *Juncus squarrosus – Festuca ovina* grassland each appear infrequently as minor components of mosaics with other communities.

Overall, the unimproved stands of U4 tend to have variable amounts of the main grasses *Agrostis capillaris, Anthoxanthum odoratum, Festuca ovina, Holcus lanatus,* occasional *Molinia caerulea* and *Deschampsia flexuosa*, and the mosses *Rhytidiadelphus squarrosus*, *R. loreus*, *Pseudoscleropodium purum*, *Hylocomium splendens* and *Pleurozium schreberi*. Other species common to U4 within the study area include *Rumex acetosa*, *Galium saxatile* and *Potentilla erecta*. A single unimproved area was mapped as the U4d *Luzula multiflora - Rhytidiadelphus loreus* sub-community featuring on damper ground with coarser swards with abundant *Deschampsia cespitosa*.

U5 was found within a single mosaic with other mire and woodland communities. U5 here, as is typical, is dominated by a sward of *Nardus stricta*. Other associates noted through the sward were similar to that of U4 mentioned above.

The U6 grassland community was rarely in mosaics with other grassland and mire communities. These particular patches were dominated by *Juncus squarrosus* with similar species to that of U4 and U5 with *Luzula multiflora* becoming common in places. Some areas did contain small patches of *Calluna vulgaris*, *Nardus stricta*, *Molinia caerulea* and the lichen *Cladonia* sp. There is an increase in bryophytes compared to U4 above with *Polytrichum commune* becoming more prominent as well as the appearance of *Rhytidiadelphus squarrosus* and *Pleurozium schreberi*. *Sphagnum* moss was also present with *Sphagnum fallax* and *S. capillifolium*. Some areas were recorded as the U6b *Carex nigra – Calypogeia trichomanis* sub-community.

The semi-improved acid grassland areas were all recorded to community level only where grazing levels were higher and the effects more visible, where the sward may have undergone some level of management and/or enrichment. These areas were less obviously acid and tend towards a more neutral assemblage with species more associated with improvement appearing. They often contained associates such as *Cynosurus cristatus, Trifolium repens, Ranunculus repens*, *R. acris* and *Rumex acetosa*.

5.3.2 B5 Marsh/Marshy Grassland

Marsh/marshy grassland is rare within the within the study area is made up of a single area of M23 *Juncus effusus/acutiflorus – Galium palustre* rush-pasture and some small areas of the MG10 *Holcus lanatus – Juncus effusus* grassland community.

These communities can be found within the north of the study area, the largest of which was found to the south of Muckle Lyne. This habitat was often closely connected with areas of damp ground, particularly along the main watercourses, tributaries and small ponds.

The M23 NVC community is species poor where the floristic components included *Juncus effusus* and at times *Juncus acutiflorus,* accompanied by *Cirsium palustre, Holcus lanatus, Deschampsia cespitosa, Rumex acetosa, Galium palustre, Epilobium palustre, Ranunculus flammula*, *R. repens*, *R. acris*, *Cardamine pratensis*, *Viola palustris*, *Caltha palustris*, *Comarum palustre, Trifolium repens, Dactylhoriza maculata*. Sedges also appeared within the M23 rush pasture with *Carex cutra, C. remota, C. rostrata* being noted.

The MG10 community was most often recorded as the MG10a Typical sub-community, often as both homogenous stands and within mosaics with other mire and grassland communities. As would be expected, this community appears within areas of damper ground. The community is dominated by a scattered, dense, tussocky, species poor sward of *Juncus effusus*. Growing through the tussocks there is usually and typically variable amounts of *Holcus lanatus, Agrostis* spp., *Ranunculus repens*, *Rumex acetosa*, *Trifolium repens, Cirsium palustre* and *C. arvense*. The moss *Rhytidiadelphus squarrosus* dominated the basal layer at times.

5.4 Heathland

5.4.1 D1.1 Dry Dwarf Shrub Heath – Acid

Acid dry dwarf shrub heath appears within the study area in the more elevated sections on thinner soils, most extensively across the summit of Cairn Duhie hill, in the form of H9 *Calluna vulgaris – Deschampsia flexuosa* heath, H10 *Calluna vulgaris – Erica cinerea heath* and H12 *Calluna vulgaris – Vaccinium myrtillus* heath. They can appear in some cases as both homogenous stands or within mosaics with other mire and heath communities.

The H9 community was often recorded as species poor with the vegetation consisting of little more than dense areas of *Calluna vulgaris*, with a few open patches allowing some diversity with *Galium saxatile*, *Blechnum spicant* and the mosses *Pleurozium schreberi* and *Hylocomium splendens*.

The H10 community was dominated by *Calluna vulgaris* with dense patches of *Erica cinerea.* Other occasional species include *Potentilla erecta*, *Galium saxatile, Deschampsia flexuosa* and *Erica tetralix.* The bryophyte layer is species poor and mainly consists of *Pleurozium schreberi*, *Rhytidiadelphus loreus, Hypnum* spp., and *Hylocomium splendens* with occasional *Cladonia* spp. (lichens).

The H12 community species assemblage is heavily dominated by *Calluna vulgaris*, and contained a low density of *Vaccinium myrtillus,* and generally lacking in species diversity. Other species found in the sward included occasional *Eriophorum angustifolium*, *Deschampsia flexuosa, Empetrum nigrum, Juncus squarrosus, Potentilla erecta, Galium saxatile* and the mosses *Dicranum scoparium*, Hypnum sp., *Pleurozium schreberi* and *Hylocomium splendens*. In some places the species assemblage allowed the sward to be classified as the H12a *Calluna vulgaris* sub-community.

5.4.2 D2 Wet Dwarf Shrub Heath

Wet dwarf shrub heath is present extensively across the study area, appearing most dominant within the central areas and, at times, features within mosaics with blanket bog habitat (see Section 5.5.1 below; Figure 7.3). This habitat is all in the form of M15 *Trichophorum germanicum – Erica tetralix* wet heath.

The M15 community is composed of varying mixtures of *Calluna vulgaris, Molinia caerulea*, *Trichophorum germanicum*, and *Erica tetralix* as the more dominant species, giving the vegetation its general character. It is generally a very variable community in terms of dominants, constants and co-dominants which can change markedly over short distances within the study area.

One of the most common forms of M15 is the M15b *Typical* sub-community. Here the *Calluna vulgaris* becomes very dominant, however, co-abundance regularly varies between *Trichophorum germanicum, Erica tetralix* and *Molinia caerulea*. These dominants make up the majority of the cover with other common species such as *Potentilla erecta*, and in moister stands, *Narthecium ossifragum* and *Eriophorum angustifolium* with occasional *Polygala serpyllifolia*. Other occasional species noted within this community were *Deschampsia flexuosa, Agrostis* spp., *Nardus stricta, Juncus squarrosus, J. effusus, J. acutiflorus, Myrica gale, Empetrum nigrum, Galium saxatile, Carex binervis, C. pauciflora, C. panicea* and *C. nigra.*

Eriophorum vaginatum is notably absent except where it occurs sparsely in mosaics and transitional zones with M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire. The basal layer is characterised by *Sphagnum capillifolium, Sphagnum fallax* and *S. palustre*. *Sphagnum papillosum, S. compactum,* and *S. tenellum* did occasionally occur within the community but are generally very localised and sparse. *Pleurozium schreberi, Hypnum* spp., *Hylocomium splendens* and *Racomitrium lanuginosum* make up the majority of the other mosses.

The M15 community also appeared occasionally as the M15c *Cladonia* spp. sub-community (see Annex C Fig. C-2). In these stands the *Calluna* is again the most dominant species. Species such as *Eriophorum angustifolium* and *Narthecium ossifragum* are much reduced, however more noticeably the basal layer exhibits a marked shift to an increased dominance of *Cladonia* spp., which often becomes locally abundant, and increasing *Racomitrium lanuginosum*. This sub-community is especially common in the drier extents of the distribution of M15 and its existence within the study area most likely represents a transition from the closely associated and surrounding M15b Typical sub-community as a result of disturbance, drying and degradation of the shallow peats.

In one instance the M15a *Carex panicea* sub-community was noted. This area was more flushed, with often this sub-community being found in close association with soakaways or drainage channels. In this instance the sward was characterised by *Carex panicea, Eriophorum angustifolium, Narthecium ossifragum, Polygala serpyllifolia, Pinguicula vulgaris, Potentilla erecta, Scorpidium scorpioides, Sphagnum palustre, S. denticulatum, S. fallax,* and *Drosera rotundifolia.* In some particularly wet areas, *Phragmites australis* was noted as present.

In general, M15 within the study area shares many of its floristics with the local bog communities and grades into these communities where the peat deepens and has an elevated water table and the presence of *Eriophorum vaginatum* becomes more noticeable. It often gives way to blanket mire on the flatter ground of the study area. Grazing, peat cutting and burning also have important effects on the floristics and structure of this community, and these historical practices have likely extended the coverage of M15 into formerly deeper and wetter peats that would likely have been banket bog.

5.4.3 D5 Dry Heath/Acid Grassland Mosaic

Dry heath/Acid grassland mosaic appears within a single area to the north of the study area where there is a mixture of dry heath and acid grassland. These areas are co-dominated by the U4 *Festuca ovina – Agrostis capillaris – Galium saxatile* grassland community and H9 *Calluna vulgaris – Deschampsia flexuosa* heath.

The floristic assemblage of the U4 grassland community resembles that detailed in Section 5.3.1 above and the H9 heath community closely resembles the communities referred to in Section 5.4.1 above.

5.4.4 D6 Wet Heath/Acid Grassland Mosaic

Wet heath/Acid grassland mosaic appears within three locations within the north of the study area where there is a mixture of wet heath and acid grassland. All of these areas are dominated by the M15 *Trichophorum germanicum – Erica tetralix* wet heath community with the U4 *Festuca ovina – Agrostis capillaris – Galium saxatile* grassland community, and the U6 *Juncus squarrosus – Festuca ovina* grassland community. The floristic assemblage of the M15 wet heath community resembles that detailed in Section 5.4.2 above and the U4 and U6 grassland communities closely resemble the communities referred to in Section 5.3.1 above.

5.5 Mire

5.5.1 E1.6.1 Blanket Bog

Blanket bog within the study area is widespread and is represented by the M2 *Sphagnum cuspidatum/fallax* bog pool community, M3 *Eriophorum angustifolium* bog pool community, M17 *Trichophorum germanicum – Eriophorum vaginatum* blanket mire, M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire and M20 *Eriophorum vaginatum* blanket mire. This is the most extensive habitat within the study area, covering 60% of the site. These communities often represent areas of relatively better quality and active blanket bog where

Sphagnum moss is often more frequent to abundant, although some areas have evidently been subject to historical drainage and peat cutting.

M2 bog pools can be found scattered across the study area with a greater concentration towards the north. The community is typically dominated by soft wet carpets of *Sphagnum cuspidatum* or *S. fallax* or both. In some places the M2 community is present as the M2b *Sphagnum fallax* sub-community which is typically more dominated by *S. fallax* and associated with more disturbed areas within the study area, such as recolonising former peat cuttings. Vascular plants occur as scattered individuals with *Eriophorum angustifolium* the most common and often extending into the pools.

M3 bog pools are also found throughout the study area. They often appear as small stands on barer exposures of peat in depressions, erosion channels or shallow peat cuttings. *Eriophorum angustifolium* is dominant here and other vascular species play a minor role. *Sphagnum* spp. are present, often composed of *S. cuspidatum, S. fallax* and *S. papillosum,* along with *Drosera rotundifolia.*

M17 appears across the study area both as homogenous stands and within mosaics. On a few occasions it was recorded as the M17b Cladonia sub-community. In these stands of M17, there is a mix of *Trichophorum germanicum* and *Eriophorum vaginatum,* although the densities can be variable in places. The sward also contains a mix of other species ranging from frequent and occasional, to locally abundant; species present included *Calluna vulgaris*, *Erica tetralix, Eriophorum angustifolium, Vaccinium myrtillus, Molinia caerulea, Empetrum nigrum, Narthecium ossifragum, Juncus squarrosus, Deschampsia flexuosa,* and *Galium saxatile*. The basal layer includes *Hylocomium splendens*, *Hypnum* sp., and *Pleurozium schreberi*. At times the lichen *Cladonia* spp. dominated the basal layer (i.e. M17b). There were also extensive carpets of *Sphagnum* moss including *Sphagnum capillifolium* and *S. palustre, S. tenellum, S. papillosum* and *S. compactum.*

M19 is the most abundant community within the study area and forms the majority of the blanket bog present. M19 alone covers 45% of the total study area. It most commonly appears in the form of the M19a *Erica tetralix* sub-community and the M19b *Empetrum nigrum* sub-community in both homogenous stands and mosaics with other NVC communities and habitats. A small amount of M19c *Vaccinium vitis-idaea – Hylocomium splendens* sub-community was also recorded. These areas of M19 as a whole are characterised by the co-dominance of *Calluna vulgaris* and *Eriophorum vaginatum* dominating throughout. There is often an equal abundance of *Vaccinium myrtillus* and *Empetrum nigrum*, however mixtures with other associates, particularly *Erica tetralix*, *Molinia. caerulea* and *Trichophorum germanicum* often attain local abundance. *Eriophorum angustifolium* is also common in places along with *Narthecium ossifragum*; *E. angustifolium* is more prominent in noticeably wetter areas. Other vascular associates are relatively few with *Deschampsia flexuosa, Carex nigra*, *Juncus squarrosus, Agrostis* spp. and *Nardus stricta* occurring occasionally throughout.

Herbs are generally limited within this M19 community, the most common being *Potentilla erecta*. The basal flora is extensively bryophytes with mixtures of *Sphagnum* and non-*Sphagnum* mosses. The most frequent *Sphagnum* species recorded were *Sphagnum capillifolium*, *S. palustre*, *S. fallax*, *S. papillosum*, *S. compactum* and *S. tenellum*. Within the drier patches of this community the levels of *Sphagna* diminish with the increase in other mosses such as *Pleurozium schreberi*, *Rhytidiadelphus loreus*, *Plagiothecium undulatum*, *Hylocomium splendens*, *Dicranum scoparium*, and *Polytrichum commune*. Lichens are frequent with *Cladonia* spp. the most common and often locally abundant.

M20 blanket mire was found most often within mosaics with other mire communities within the study area, usually identified by the dominant tussocks of *Eriophorum vaginatum* with frequent *Eriophorum angustifolium* and often found in close association with the M19 community. Other species were noted in small amounts, namely, *Vaccinium myrtillus*, *Potentilla erecta*, *Galium saxatile* and graminoids *Deschampsia flexuosa*, *D. cespitosa* and *Molinia caerulea*. Where carpets of *Sphagnum* moss were evident the species *Sphagnum fallax, S. capillifolium* and *S. compactum* were recorded. Within the drier areas *Polytrichum commune* and *Hylocomium splendens* became more prevalent. The M20a Species-poor sub-community was recorded in one instance and more commonly as the relatively more species rich M20b *Calluna vulgaris-Cladonia* sub-community where the lichen *Cladonia* sp. becomes a key component within this assemblage.

Areas of the blanket bog have evidently been anthropogenically impacted in the past through historical drainage and peat cutting, burning and grazing may also have occurred in the past. However, on the whole the blanket bog in the study area, whilst not pristine and partially degraded to varying degrees, does contain a moderate coverage of Sphagna and other peat forming species which would indicate the majority of the bog continues to be active. Much of the M19 blanket mire onsite often grades into other similar NVC communities creating overlap, transitional areas, and complex mosaics of communities. Some of this is due to natural abiotic factors and environmental gradients at a finer scale, however at the site there is a large degree of overlap as a consequence of past management, such as relatively recent and historical peat harvesting, burning, grazing and drainage affecting the presence and proportions of many plant species and consequently blurring vegetative boundaries. The M19 mire onsite as a result most commonly forms mosaics with M15 wet heath, but also with M17 and M20 blanket mire in some areas.

Drainage, and peat cutting with its associated disturbance and oxidation of the acrotelm and upper catotelm, and increasing water flow off the mire, can convert the M19 community into heath or grassland. As M19 is one of the drier bog types drainage can cause a shift of M19 mire to a wet heath, most obvious and diagnostic is the decreasing vigour and often loss of *Eriophorum vaginatum*, this is evident onsite by the common shift in communities between M19 and M15, and vice-versa. Further transitions to dry heath can occur where ericoid species become overwhelmingly dominant.

5.5.2 E1.7 Wet Modified Bog

Wet modified bog appears in the form of the M25 *Molinia caerulea – Potentilla erecta* mire NVC community. The M25 mire areas were identified due to *Molinia* dominating the field layer within the study area (see Annex C Photo C-4). This community appears most commonly in the form of the M25a *Erica tetralix* sub-community and, on one occasion, as the more species rich M25c *Angelica Sylvestris* sub-community. The M25 mire community was also found within mosaics with other mire, heath and grassland communities. The majority of the species found within this assemblage were species poor with *Molinia* sparsely accompanied by *Calluna vulgaris*, *Juncus squarrosus*, *Vaccinium myrtillus*, *Deschampsia flexuosa*, *Holcus lanatus*, and very occasional *Trichophorum germanicum*. Within the M25c sub-community, *Succisa pratensis* appears amongst the more abundant herbs along with *Viola palustris* and a greater abundance of *Sphagnum* moss. Within the wetter areas of this community, the rush *Juncus effusus* becomes more abundant. Occasional dense patches of *Sphagnum* moss appear, particularly *Sphagnum capillifolium*, although this was often found to be in more transitional areas with other more *Sphagnum* rich blanket bog communities. Within the drier areas of the community, other mosses such as *Polytrichum commune* and *Hylocomium splendens* were more dominant.

5.5.3 E2.1 Acid/Neutral Flush/Spring

Acid/neutral flush within the study area is represented by the M6 *Carex echinata - Sphagnum fallax/denticulatum* mire NVC community. This community was often found within areas where there are small flushes, runnels or

soakways, and along and within occluding ditches and around minor watercourses or as small components of modified bog.

The M6 mire community appears in a number of forms within the study area, these being; M6a *Carex echinata* sub-community, M6b *Carex nigra – Nardus stricta* sub-community and M6c *Juncus effusus* sub-community. Of these sub-communities M6b and M6c are the most common with M6a appearing as a single isolated patch. M6a and M6b are characterised by the more sedge rich assemblage compared to that of the M6c sub-community.

Carex echinata is present in the M6a stand but is generally sparse, although other associates are represented in sufficient numbers to allow the classification. M6b is the more common sedge rich sub-community with the presence of *Carex nigra, C. panicea, C. rostrata* and *C. curta* although *Nardus stricta* is notably absent or at best very scarce. Among the grasses *Agrostis canina, Molinia caerulea* and *Anthoxanthum odoratum* were noted but not dominant. The general species variety and abundance varied across this community with *Viola palustris, Potentilla erecta*, *Galium saxatile*, *G. palustre*, *Cirsium palustre*, *Ranunculus flammula*, *R. repens*, *R. acris*, *Succisa pratensis*, *Cardamine pratensis*, *Rumex acetosa, Caltha palustris, Dactylhoriza maculata* and *Myrica gale.*

Many areas within the community had a prominent ground carpet of *Sphagnum* spp. which most frequently is dominated by *Sphagnum fallax* with *S. palustre* often being co-dominant. Other bryophytes are sparse but *Polytrichum commune* is frequent, particularly in stands of M6c *Juncus effusus* sub-community.

5.5.4 E3.2 Fen - Basin Mire

Basin mire within the study area is represented by the M4 *Carex rostrata - Sphagnum fallax* mire NVC community. This community was found within the north of the study area within the small ponds undergoing terrestrialisation, south of Muckle Lyne. The community appears within three areas, in close proximity.

As is typical for this mire community, *Carex rostrata* is very much dominant, almost to the exclusion of all other species, except for occasional *C. nigra.* The basal layer is a very extensive wet carpet of almost exclusively *Sphagnum fallax* with only occasional *S. cuspidatum*, *S. denticulatum* and *S. palustre*.

5.6 Swamp, Marginal & Inundation Habitats

5.6.1 F1 Swamp

Swamp within the study area is represented by the S9 *Carex rostrata* swamp NVC community and appears once within a mosaic dominated by the M4 mire community referred to in Section 5.5.4 above. The S9 community is readily recognised by the tall, dense growth of *Carex rostrata* rooted in shallow water. Separation from other communities in which *C. rostrata* is present is based on its almost exclusive dominance in this community and the low cover and richness of associates. It was recorded within the north of the study area and was composed of an area of dominant and species poor *C. rostrata*.

5.7 Open Water

5.7.1 G1 Standing Water

A single area of standing water (SW) was recorded within the study area, forming a mosaic with the M4 mire community and S9 swamp community, detailed in Section 5.6.1 above.

5.8 Invasive Non-Native Species

No Invasive Non-Native Species (INNS) were incidentally recorded during the habitat surveys; however, this does not preclude their presence from the study area.

5.9 Notable Species

No notable or rare species were incidentally recorded during the habitat surveys; however, this does not preclude their presence from the study area.

6 EVALUATION OF BOTANICAL INTEREST

6.1 Overview

NVC communities can be compared with a number of habitat classifications in order to help in the assessment of the sensitivity and conservation interest of certain areas. The following sections compare the survey results and the NVC communities identified against three classifications:

- SEPA guidance on Groundwater Dependent Terrestrial Ecosystems (GWDTEs);
- Habitats Directive (92/43/EEC) Annex I habitats; and
- Scottish Biodiversity List (SBL) priority habitats.

6.2 Groundwater Dependent Terrestrial Ecosystems (GWDTE)

SEPA has classified a number of NVC communities as potentially dependent on groundwater (SEPA, 2017a & 2017b). Wetlands or habitats containing these particular NVC communities are to be considered GWDTE unless further information can be provided to demonstrate this is not the case. Many of the NVC communities on the list are very common habitat types across Scotland, and some are otherwise generally of low ecological value. Furthermore, some of the NVC communities may be considered GWDTE only in certain hydrogeological settings.

Designation as a potential GWDTE does not therefore infer an intrinsic biodiversity value, and GWDTE status has not been used as criteria to determine a habitats respective conservation importance. There is however a statutory requirement to consider GWDTEs and the data gathered during the NVC surveys has been used to inform this assessment (see Chapter 6: Hydrology, Hydrogeology, Geology and Peat).

Using SEPA's guidance,

Table 6-1 shows which communities recorded within the study area may be considered GWDTE. Those communities which may have limited (moderate) dependency on groundwater in certain settings are marked in yellow and NVC communities recorded that are likely to be considered high, or sensitive GWDTE in certain hydrogeological settings are highlighted in red.

Table 6-1 Communities within the study area which may potentially be classified as GWDTE

NVC Code	NVC Community Name
M15	*Trichophorum germanicum – Erica tetralix* wet heath
M25	*Molinia caerulea – Potentilla erecta* mire
MG10	*Holcus lanatus – Juncus effusus* rush pasture
U6	*Juncus squarrosus – Festuca ovina* grassland
W4	*Betula pubescens – Molinia caerulea* woodland
M6	*Carex echinata – Sphagnum fallax/denticulatum* mire
M23	*Juncus effusus/acutiflorus – Galium palustre* rush pasture

The location and extent of all identified potential GWDTE are provided on an appropriate NVC map; see Figure 7.4.

Within Figure 7.4 the potential GWDTE sensitivity of each polygon containing a potential GWDTE is classified on a four-tier approach as follows:

- 'Highly – dominant' where potential high GWDTE(s) dominate the polygon
- 'Highly - sub-dominant' where potential high GWDTE(s) make up a sub-dominant percentage cover of the polygon
- 'Moderately – dominant' where potential moderate GWDTE(s) dominate the polygon and no potential high GWDTEs are present
- 'Moderately - sub-dominant' where potential moderate GWDTE(s) make up a sub-dominant percentage cover of the polygon and no potential high GWDTEs are present.

Where a potential high GWDTE exists in a polygon it outranks any potential moderate GWDTE communities within that same polygon.

GWDTE sensitivity has been assigned solely on the SEPA listings (SEPA, 2017a & 2017b). However, depending on a number of factors such as geology, superficial geology, presence of peat and topography, many of the potential GWDTE communities recorded may in fact be only partially groundwater fed or not dependant on groundwater. Determining the actual groundwater dependency of particular areas or habitat requires further assessment (see Chapter 6: Hydrology, Hydrogeology, Geology and Peat).

6.3 Annex I Habitats

6.3.1 Overview

A number of NVC communities can also correlate to various Annex I habitat types. However, the fact that an NVC community can be attributed to an Annex I type does not necessarily mean all instances of that NVC community constitute Annex I habitat. Its Annex I status can depend on various factors such as quality, extent, species assemblages, geographical setting and substrates.

Using Joint Nature Conservation Committee (JNCC) Annex I habitat listings and descriptions[4], which have then been compared with survey results and field observations, the following NVC communities within the study area which constitute Annex I habitat are shown in Table 6-2.

Table 6-2 Annex I Habitats and Corresponding NVC Communities

Annex I Habitat	Corresponding NVC Communities & Other Non-NVC Habitats/Features Recorded
4010 North Atlantic wet heaths with *Erica tetralix*	M15 *Trichophorum germanicum – Erica tetralix* wet heath
4030 European dry heaths	H9 *Calluna vulgaris – Deschampsia flexuosa* heath H10 *Calluna vulgaris - Erica cinerea* heath H12 *Calluna vulgaris – Vaccinium myrtillus* heath
7130 Blanket bog	M2 *Sphagnum cuspidatum/fallax* bog pool community M3 *Eriophorum angustifolium* bog pool community M17 *Trichophorum germanicum – Eriophorum vaginatum* blanket mire M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire M20 *Eriophorum vaginatum* blanket mire
7140 Transition mires and quaking bogs	M4 *Carex rostrata - Sphagnum fallax* mire

Further details on the inclusion or omission of certain NVC communities/sub-communities and/or Annex I types are also provided below.

6.3.2 7130 Blanket bog

The blanketing of the ground with a variable depth of peat gives the habitat type its name and results in the various morphological types according to their topographical position. Blanket bogs show a complex pattern of variation related to climatic factors, particularly illustrated by the variety of patterning of the bog surface in different parts of the UK. Such climatic factors also influence the floristic composition of bog vegetation.

'Active' bogs are defined as supporting a significant area of vegetation that is normally peat-forming. Typical species include the important peat-forming species, such as *Sphagnum* spp. and *Eriophorum* spp., or *Molinia caerulea* in certain circumstances, together with *Calluna vulgaris* and other ericaceous species. The most abundant NVC blanket bog types are M17, M18, M19, M20 and M25.

Annex I type 7130 Blanket bog therefore correlates directly with a number of NVC communities within the study area such as the M17, M19 and M20 mires. However, 7130 Blanket bog can also include bog pool communities (M1-M3) where these occur within blanket mires such as M17-M20. As such M2 and M3 within the study area are also assigned to the blanket bog Annex I type, as they are often associated with areas of M17, M19 and M20 mire.

As noted above, M25 mire can also fall within the blanket bog Annex I type, usually where the underlying peat depth is greater than 0.5m and the habitat is wet and contains peat forming species. As described in Section 5.5.2 above, M25 within the study area is for the most part species-poor and at the drier end of the scale. Many areas are a ubiquitous swathe of *Molinia* tussocks with few associate species and generally lack many of the main peat forming species such as *Sphagnum* mosses. General field observations of M25 indicate, together with the results obtained from a peat depth survey carried out in 2012 by MacArthur Green[5], that this habitat is unlikely to be on deep peat within the study area. Given the character of the majority of M25 within the study area it has not been considered to be of Annex I habitat quality in this case.

6.3.3 7140 Transition mires and quaking bogs

All examples of M4 *Carex rostrata - Sphagnum fallax* mire within the study area were assigned to the Annex I type Transition mires and quaking bogs. The term 'transition mire' relates to vegetation that in floristic composition and general ecological characteristics is intermediate between acid bog and alkaline fen.

6.3.4 4010 Northern Atlantic wet heaths with *Erica tetralix*

Wet heath usually occurs on acidic, nutrient-poor substrates, such as shallow peats or sandy soils with impeded drainage. The vegetation is typically dominated by mixtures *Erica tetralix*, *Calluna vulgaris*, grasses, sedges and *Sphagnum* bog-mosses. All examples of M15 wet heath within the study area were included within the 4010 Northern Atlantic wet heaths category.

6.3.5 4030 European dry heaths

European dry heaths typically occur on freely-draining, acidic to circumneutral soils with generally low nutrient content. Ericaceous dwarf shrubs dominate the vegetation. The most common dwarf shrub is *Calluna vulgaris*.

The dry heath communities recorded within the study area – H9, H10, and H12 – all fall within this Annex I type. These NVC types can also be included within the Annex I type H4060 Alpine and Boreal heaths, but only where they are at higher altitudes and include arctic-alpine floristic elements. These communities within the study area are lower altitudinal examples so they all fall under the 4030 European dry heaths Annex I type.

6.3.6 91C0 Caledonian forest

Caledonian forest comprises relict indigenous pine forests of *Pinus sylvestris*, and associated *Betula* spp. and *Juniperus communis* woodlands of northern character. The majority of this habitat corresponds to NVC type W18 *Pinus sylvestris – Hylocomium splendens* woodland.

W18 woodland within the study area is all of planted origin. Thinning of the canopy over time has allowed the development of a ground flora in many stands, but because of their planted origin none of the W18 within the study area has been deemed a candidate area for Annex I H91C0 Caledonian forest status.

6.4 Scottish Biodiversity List Priority Habitats

The SBL is a list of animals, plants and habitats that Scottish Ministers consider to be of principal importance for biodiversity conservation in Scotland. The SBL was published in 2005 to satisfy the requirement under Section 2(4) of The Nature Conservation (Scotland) Act 2004.

[4] http://jncc.defra.gov.uk/page-1523
[5] MacArthur Green (2012). Cairn Duhie Peat Depth Survey & Information to Inform an Assessment of Blanket Mire Condition. Report for RES.

The SBL identifies habitats which are the highest priority for biodiversity conservation in Scotland: these are termed 'priority habitats'. Some of these priority habitats are quite broad and can correlate to many NVC types.

The relevant SBL priority habitat types (full descriptions of which can be found on the SNH website[6]), and associated NVC types recorded within the study area are as follows:

- Upland birchwoods: W4 (at community level);
- Wet woodland: W4c;
- Blanket bog: M17, M19, M20, and M2-M3 (M2-M3 where associated with M17-M20), and M15[7] where peat depth is greater than 0.5m;
- Upland flushes, fens and swamps: S9, M4 and M6; and
- Upland heathland: M15, H9, H10 and H12.

These SBL priority habitats correspond with UK Biodiversity Action Plan (BAP) Priority Habitats[8].

6.5 Sensitivity Summary

Table 6-3 provides a summary of all the NVC communities and non-NVC types recorded within the study area and any associated habitat sensitivities as described in the sections above.

Table 6-3 Summary of study area communities and sensitivities

NVC/Non-NVC Codes Recorded	Potential GWDTE Status	Annex I Habitat	SBL Priority Habitat Type
Mires & Wet Heath			
M2, M2b	-	7130 Blanket bogs (examples associated with M17-M20)	Blanket bog
M3	-	7130 Blanket bogs (examples associated with M17-M20)	Blanket bog
M4	-	7140 Transition mires and quaking bogs	Upland flushes, fens and swamps
M6, M6a, M6b, M6c	High	-	Upland flushes, fens and swamps
M15, M15a, M15b, M15c	Moderate	4010 Northern Atlantic wet heaths with *Erica tetralix*	Upland heathland, and Blanket bog (where peat depth >0.5m)
M17, M17b	-	7130 Blanket bogs	Blanket bog
M19, M19a, M19b	-	7130 Blanket bogs	Blanket bog
M20, M20a, M20b	-	7130 Blanket bogs	Blanket bog
M23	High	-	-
M25, M25a, M25c	Moderate	-	-
Dry Heaths			
H9	-	4030 European dry heaths	Upland heathland
H10	-	4030 European dry heaths	Upland heathland
H12, H12a,	-	4030 European dry heaths	Upland heathland
Calcifugous Grasslands			
U4, U4d	-	-	-
U5	-	-	-
U6, U6b	Moderate	-	-
Mesotrophic Grasslands			
MG10a	Moderate	-	-
Woodland & Scrub			
W4, W4c	High	-	Upland Birchwoods, and Wet woodland
W18, W18a	-	-	-
W23	-	-	-
Swamps & Tall-Herb Fens			
S9	-	-	Upland flushes, fens and swamps
Non-NVC Types			
CP	-	-	-
SW	-	-	-

[6] https://www.nature.scot/landscapes-and-habitats/habitat-types/habitat-definitions
[7] Excluding the M15a *Carex panicea* sub-community, due to its general flushed nature over shallower substances.

7 SUMMARY

MacArthur Green carried out NVC and habitat surveys within the study area from 2nd to 4th December 2019 inclusive in order to identify those areas of vegetation communities with the greatest ecological or conservation interest. These surveys were an update on previous NVC surveys undertaken at the site in June 2012 for the Consented Development. Given the time since the original surveys were undertaken, the 2019 surveys were conducted to verify, update and amend mapping boundaries and habitat classifications, where necessary.

In total 21 NVC communities were recorded within the respective study area along with various associated sub-communities; a number of non-NVC habitat types are also present. Only a small number of communities or habitat types account for the majority of the study area.

[8] http://jncc.defra.gov.uk/page-5718

The most common and widespread communities making up the bulk of the landscape are M15 *Trichophorum germanicum – Erica tetralix* wet heath and M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire. To a lesser extent, scattered between the wet heath and blanket bog habitats, are patches and pockets of other habitat types such as acid grassland, marshy grassland, woodland and dry heath.

Although some large relatively homogeneous stands of vegetation occur, most of the communities often form complex mosaics and transitional areas across the study area.

The survey results have also been compared to a number of sensitivity classifications, indicating the presence of Annex I, SBL and potential GWDTE habitats, as summarised in Table 6-3.

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ANNEX A. NVC TARGET NOTES

A number of target notes were also made during surveys, often to pinpoint springs/flushes, or an area or species of interest, these target notes are shown on Figure 7.3 and detailed within Table A.1 below. A representative sample of corresponding target note photographs is provided in Annex B.

Table A-1 Study Area Target Notes

Target Note ID	Easting	Northing	NVC Community	Description	Photo Reference
1	296836	844023	M2b	Pool with *Eriophorum angustifolium*, *E. vaginatum*, *Sphagnum cuspidatum*, abundant *S. fallax*, *S. papillosum*	B-1
2	296843	844046	M2	Pool with *Eriophorum angustifolium, E. vaginatum*, *Sphagnum cuspidatum*, abundant *S. fallax*, *S. papillosum*	
3	296865	844082	M2/M15/M17	Locally an area of mixed bog and wet heath of M15, M17 and M2 bog pools within area of designated Class 1 peatland. Good Sphagnum diversity with small isolated patches of eroded peat. Species include *Eriophorum vaginatum*, *Calluna vulgaris*, *Trichophorum germanicum*, *Deschampsia flexuosa*, *Juncus squarrosus*, *Erica tetralix*, *Narthecium ossifragum*, *Sphagnum capillifolium*, *S. palustre*, *Cladonia* spp., *Hypnum* sp., *Pleurozium schreberi* and *Hylocomium splendens*	B-2
4	297966	844654	M17/M19/M20	Area within Class 1 peatland from Carbon and Peatland 2016 Map. Species diversity good and fenced off to minimise grazing pressures	B-3
5	298467	844816	M17/M19	Drainage across some areas of the site	
6	298160	844021	M19	Area has been drained at some point in the past. *Calluna vulgaris* is dominant with *Eriophorum vaginatum* in some patches. Wetter areas contain high abundance of *Sphagnum* moss	
7	297169	841846	M2	Abundant *Sphagnum cuspidatum*, *S. fallax* and *Eriophorum angustifolium*	
8	297619	842151	N/A	Some drainage across the area within area of designated Class 1 peatland. Small bog pools also scattered across this area. Most dominant species include abundant *Cladonia* sp., *Calluna vulgaris*, *Eriophorum angustifolium*, *Erica tetralix*, *Trichophorum germanicum*, *Pleurozium schreberi*, *Sphagnum papillosum*, *S. cuspidatum*. M17 and M19 most dominant communities across this area.	
9	297432	842263	M3	*Eriophorum angustifolium, Erica tetralix, Sphagnum papillosum* and *S. cuspidatum*.	B-4
10	297104	843311	M15	*Neottia cordata* amongst wet heath. (2012 TN).	
11	297220	843844	M15	*Neottia cordata* found amongst dense *Calluna vulgaris*. (2012 TN).	
12	297082	842897	M6c	Very small area of flush running down to road. Species include *Juncus effusus, Holcus lanatus, Cirsium palustre, Sphagnum* spp., *Agrostis* sp., *Deschampsia cespitosa, Ranunculus flammula, Rumex acetosa* and *Epilobium palustre*. (2012 TN).	
13	297354	843453	M15a	Small area of with *Molinia caerulea, Erica tetralix, Narthecium ossifragum, Agrostis* sp., *Dactylhoriza maculata, Galium* spp., and *Eriophorum angustifolium*. Some patches of *Sphagnum capillifolium* present. (2012 TN)	
14	298242	843663	M6c	*Juncus effusus, Polytrichum commune* and *Sphagnum fallax* dominate. (2012 TN)	

ANNEX B. TARGET NOTE PHOTOGRAPHS

The following photographs correlate to the target notes described within Annex A, Table A.1. Photographs are not provided here for all target notes, due to the similarity in many photographs.

Photo B-1 Target Note 1: M2 *Sphagnum cuspidatum/fallax* bog pool – *Sphagnum fallax* sub-community

Photo B-2 Target Note 3: Area of wet dwarf shrub heath and blanket bog mosaic (M15, M17 and M2)

Photo B-3 Target Note 4: M17 *Trichophorum germanicum – Eriophorum vaginatum* blanket mire

Photo B-4 Target Note 9: M3 *Eriophorum angustifolium* bog pool

ANNEX C. GENERAL COMMUNITY PHOTOGRAPHS

The following selected photographs are provided to give a visual representation to a number of the community types present within the study area.

Photo C-1: Mosaic dominated by M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire

Photo C-2: M15c *Trichophorum germanicum – Erica tetralix - Cladonia* spp. sub-community

Photo C-3: W4 *Betula pubescens – Molinia caerulea* woodland

Photo C-4: M25 *Molinia caerulea – Potentilla erecta* mire

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Cairn Duhie Wind Farm
Bat Survey Report
Appendix 7.3

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EXECUTIVE SUMMARY

MacArthur Green was commissioned by RES (the 'Applicant') to carry out bat surveys for the proposed Cairn Duhie Wind Farm by Ferness, Highland (hereafter referred to as the 'Proposed Development').

This report presents the results of the bat survey work undertaken between May to September 2012 which includes preliminary ground level roost assessments (PRA) which were updated in December 2019 based on the site boundary at the time of survey.

Between May to September 2012, bats were detected on 26 nights during automated surveys, using four static bat detectors with a total of four bat species and one genus classification recorded for the site during spatial an automated surveys: soprano pipistrelle (*Pipistrellus pygmaeus*), common pipistrelle (*Pipistrellus pipistrellus*), brown long-eared bat (*Plecotus auritus*) Daubenton's bat (*Myotis daubentonii*) and *Myotis* spp.

Common and soprano pipistrelle bats registrations accounted for 95.8% of the registrations recorded during automated activity surveys.

No trees or structures with bat roost features (PRFs) were recorded during the PRA.

To assess the potential effects of the Proposed Development on bats, an overall risk assessment was carried out in accordance with SNH *et al.* (2019) guidance for high collision risk bat species (soprano pipistrelle and common pipistrelle). The assessment which was calculated using both the median and maximum percentiles concluded an overall risk assessment score of 'Low' for common pipistrelle and 'Medium' for soprano pipistrelle, based on the median percentiles. Both common and soprano pipistrelle recorded a 'Medium' risk assessment score calculated from the maximum percentiles. No 'High' risk assessment scores were recorded for the site.

In total, based on the median percentiles, it was calculated that the highest percentage of 'Medium' risk scores was recorded in July (75%). The maximum percentile scores which can be used to calculate peaks in bat activity, calculated peaks in activity during July and August with 100% and 75% of all locations surveyed recording a 'Medium' risk assessment score, respectively.

1 INTRODUCTION

MacArthur Green was commissioned by RES (the 'Applicant') to carry out bat surveys for the proposed Cairn Duhie Wind Farm by Ferness, Highland (hereafter referred to as the 'Proposed Development').

This report presents the results of the bat survey work undertaken between May to September 2012 for the Cairn Duhie Wind Farm Environmental Statement (ES) (consented in 2017 and hereafter referred to as the 'Consented Development'), and updated preliminary ground level roost assessments (PRA) completed in December 2019. Surveys were carried out for the Proposed Development within the bat survey study area as shown in Figure 7.6.

The assessment for the Consented Development concluded a negligible effect on bats. There has been no major habitat or land use change on the site since the previous assessment that would alter bat use or activity levels over the site. Therefore, no further automated bat activity surveys were undertaken for the Proposed Development with the 2012 data considered sufficient, and this approach was agreed in communication with Scottish Natural Heritage (SNH) via consultation correspondence on the 3rd April and 16th June 2020.

Bat surveys to inform the assessment included:

- Desk study;
- A Preliminary Bat Roost Assessment (PRA), 2012, and re-surveyed 2019;
- Spatial (transect) surveys, 2012; and
- Automated activity surveys, 2012.

Bat data collected during automated activity surveys in 2012 has been re-analysed in line with SNH et al. (2019) guidance.

The aim of these surveys and analysis in line with SNH *et al.* (2019) guidance was to assess the potential effects of the Proposed Development on bats and to determine the site risk assessment for high collision risk bat species.

2 THE SITE & STUDY AREA

The Proposed Development site ('the site') is situated approximately 2km south-east of Ferness and approximately 15km south-east of Nairn, extending to approximately 663.65 hectares (ha). The Proposed Development is located on the site of the consented Cairn Duhie Wind Farm (i.e. the Consented Development). The Proposed Development is a re-design of the Consented Development.

The site is bounded to the west by the A939 road and the B9007 to the north and follows the Moray Council local authority boundary to the east. The site is within the administrative boundary of the Highland Council (THC).

The landform of the site is characteristic of the wider landscape, comprising open upland with a mixture of land cover, including bog and heath habitats with localised wooded areas and scattered mature trees, with coniferous plantations occupying areas to the north. In addition, 275 kilovolt (kV) overhead transmission lines mounted on steel towers traverse the northern part of the site to the west. Contained within the site is the low conical hill of Cairn Duhie, marking the highest point (at 312m Above Ordnance Datum (AOD)). Land gently slopes down from this point in all directions, reaching the lowest point to the north of the site (200m AOD). The site is enclosed by higher topography to the south and east by the Hill of Aitnoch (413m AOD) and the Knock of Braemoray (456m AOD) respectively.

There are several minor watercourses located within the site, including evidence of systematic drainage channels, as well as the Burn of Lochantùtach, which drains the southern extents of the site and is a tributary of the Dorback Burn which flows perpendicular to the east of the site. The northern part of the site is drained by the Stripe of Muckle Lyne and the Stripe of Little Lyne, which both drain northwards into the River Findhorn. To the south of the site lies Lochan Tùtach.

The 'study area' in which bat surveys were undertaken covered the entirety of the site and a small extension of this area to the south by Lochan Tùtach. The study area is shown in Figure 7.6.

3 BATS AND WIND FARMS

3.1 Policy and Guidance

All bat species are protected under the following legislation:

- The Habitats Directive 92/43/EEC (as amended);
- The Wildlife and Countryside Act 1981 (as amended); and
- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended).

Details pertaining to the legal status of bats are included within Annex A and in Table A-1.

In the UK and Europe, guidelines have been produced with regards to assessing the ecological impact upon bats from wind farm developments. These guidelines help to inform survey and mitigation strategies.

The following guidance documents have been used in the preparation of this report:

- Hundt, L. (2012). *Bat Surveys: Good Practice Guidelines*. 2nd Edition. Bat Conservation Trust;
- Natural England (2014). *Bats and onshore wind turbines: interim guidance.* 3rd Edition. TIN051. English Nature;
- Collins, J. (ed) (2016). *Bat Surveys for Professional Ecologists: Good Practice Guidelines*. 3rd Edition. The Bat Conservation Trust, London; and
- Scottish Natural Heritage, Natural England, Natural Resources Wales, Renewable UK, Scottish Power Renewables, Ecotricity Ltd, the University of Exeter & Bat Conservation Trust (BCT). (2019). *Bats and Onshore Wind Turbines: Survey Assessment and Mitigation*.

Surveys were conducted prior to the release of SNH *et al.* (2019) guidance and as such were based on the preceding Hundt (2012) guidance. The following analysis of bat data and assessment of bat activity for automated activity surveys has been revised and updated in line with SNH *et al.* (2019) guidance, to gain a measure of relative bat activity at the site.

4 METHODS

The site was assessed as a 'medium' risk for bats in 2012 due to the habitats being assessed as moderately suitable for bats (Cairn Duhie Wind Farm ES, 2012). As defined in Hundt (2012) medium risk sites require monthly bat surveys from April to October[1].

4.1 Desk-Based Study

A National Biodiversity Network (NBN)[2] Atlas Scotland search was completed to obtain bat records from 2010 to 2020 within 10km of the site boundary.

4.2 Field Survey Methods

4.2.1 Preliminary Bat Roost Assessment

The PRA carried out in 2019 followed the assessment methodology as set out in Collins (2016), to identify any Potential Roost Features (PRFs) in trees, buildings and structures, which could support roosting bats and to search for evidence of roosting bats; this survey was an update to the PRA already carried out in 2012 for the Consented Development. Where PRFs were identified, they were assigned a value of low, moderate or high suitability which indicates the likelihood of bats being present and informs the requirement for further survey work, such as a climbing inspection and/or dusk and dawn activity surveys.

The PRA was carried out within the site boundary.

4.2.2 Spatial surveys

Spatial (transect) surveys were carried out from May to September in 2012, totalling six survey visits to the site. Table B-1 of Annex B provides an overview of the recording dates completed in 2012. A total of two transects and 35-point counts were surveyed on each survey visit. The results of the spatial survey include species recorded and bat passes per hour (bpph) which are discussed in Section 6.3. No further analysis of spatial data was completed during the preparation of this report.

4.2.3 Automated Activity Surveys

A total of six survey visits to the site were completed from May to September 2012, with four SD2 Anabat detectors recording zero crossing files deployed for a minimum period of five consecutive nights. This resulted in a total of 29 nights of survey and 113 associated data recording nights across the bat survey season. The Anabat locations were not altered throughout the survey period and can be seen in Figure 7.6. Table B-2 of Annex B provides an overview of the recording dates and times completed in 2012. Table B-3 of Annex B lists the detector location and a description of the habitat type. Each automated detector recorded bats from dusk to dawn with detectors starting 30 minutes before dusk and finishing 30 minutes after dawn.

Data was analysed in 2012 using AnalookW software to determine species identification and bpph. In line with SNH *et al.* (2019) guidance, further analysis of bat data was carried out in 2020 using the secure online tool *Ecobat* (Mammal Society, 2017), to gain a measure of relative bat activity at the site. Ecobat data was then evaluated in accordance with SNH *et al.* (2019) guidance tables to determine the overall site risk level. The methods for analysing automated bat activity levels using SNH *et al.* (2019) guidance is discussed in Section 4.3. Analysis of bat data using the *Ecobat* tool and the reference ranges used are discussed in Section 4.3.1.

4.3 Methods for Analysing Bat Activity Levels and Risks

SNH *et al.* (2019) details an updated methodology for analysing bat activity levels. This method is summarised below and involves the following steps:

1. Estimating bat activity levels;
2. Categorising collision risk of the relevant species;
3. Identifying population relevant abundance (size of the populations);
4. Categorising the potential vulnerability of bat populations by combining collision risk with population abundance;
5. Categorising the site risk level;
6. Completing the overall risk assessment; and
7. An assessment of significance and mitigation.

The following sections outlines the methods used in each step.

4.3.1 Step 1: Bat Activity Levels

A measure of relative bat activity was obtained using the secure online tool *Ecobat* (Mammal Society, 2017) for automated data. SNH *et al.* (2019) guidance explains that, "*The tool compares data entered by the user with bat survey information collected from similar areas at the same time of year and in comparable weather conditions…. Ecobat generates a percentile rank for each night of activity and provides a numerical way of interpreting the levels of bat activity recorded at a site across regions in Britain*". **Error! Reference source not found.** below, taken from SNH *et al.* (2019) guidance shows the five percentile categories for ease of reference. Only static data from automated activity surveys was analysed with the Ecobat tool.

The reference range data set were stratified to include:

- Records from any time of year;
- Only records from within 100km^2 of the survey location; and
- Records using any make/model of bat detector.

Table 4-1: Percentile Score and Categorised Level of Bat Activity[3]

Percentile Score	Bat Activity
81 to 100	High
61 to 80	Moderate to High
41 to 60	Moderate
21 to 40	Low to Moderate

[1] Bat activity surveys in Scotland begin in May due to sub-optimal weather conditions in April.
[2] NBN Atlas. Available at: https://nbnatlas.org. Accessed on: 25/06/2020

[3] Table sourced from: Scottish Natural Heritage, Natural England, Natural Resources Wales, Renewable UK, Scottish Power Renewables, Ecotricity Ltd, the University of Exeter & Bat Conservation Trust (BCT). (2019). *Bats and Onshore Wind Turbines: Survey Assessment and Mitigation*.

Percentile Score	Bat Activity
0 to 20	Low

4.3.2 Step 2: Vulnerability to collision

SNH *et al.* (2019) guidance presents a generic assessment of vulnerability to collision for UK species, based on species behaviour, flight characteristics and casualties in the UK and the rest of Europe. Table 4-2Table 4-2 below provides a summary of this information by showing the bat species vulnerable to collision.

Habitat characteristics at the location of wind turbines can have an important influence on vulnerability of bat species to collision. For example, proximity to key feeding sites and commuting routes such as water features and woodland edge habitats is known to increase the likelihood of bat collision SNH *et al.* (2019).

Table 4-2: Vulnerability of Bat Species to Turbine Impact in the UK[3].

Risk of Turbine Impact (Collision Risk)		
Low Risk	**Medium Risk**	**High Risk**
Myotis spp.	Serotine	Common pipistrelle
Long eared bats	Barbastelle	Soprano pipistrelle
Horseshoe bats		Noctule
	#	Leisler's bat
	#	Nathusius' pipistrelle

4.3.3 Step 3: Population Relative Abundance

SNH *et al.* (2019) guidance details the sensitivity of a bat species to impact based on their population's relative abundance in Scotland as detailed in Table 4-3. Species with the rarest relative abundance are more susceptive to significant effects.

Table 4-3: Population Relative Abundance of Bats in Scotland[3].

Relative Abundance	Species
Common	Common pipistrelle
	Soprano pipistrelle
Rarer	Brown long eared bat
	Daubenton's bat
	Natterer's bat
Rarest	Whiskered bat
	Brandt's bat
	Nathusius' pipistrelle
	Noctule bat
	Leisler's bat

4.3.4 Step 4: Potential Vulnerability of Bat Populations

Table 4-4 below, sourced from SNH *et al.* (2019) guidance, uses the measure of collision risk, in combination with relative population abundance, to indicate the potential vulnerability of populations of British bat species. The overall potential vulnerability of bat populations is identified as: low (yellow), medium (orange), high (red).

Table 4-4: Level of Potential Vulnerability of Populations of British Bat Species[3].

Relative Abundance of Bats in Scotland	Collision Risk		
	Low collision risk	Medium collision risk	High collision risk
Common species			Common pipistrelle Soprano pipistrelle
Rarer species	Brown long eared bat Daubenton's bat Natterer's bat		
Rarest species	Whiskered bat Brandt's bat		Nathusius' pipistrelle Noctule bat Leisler's bat

4.3.5 Step 5: Categorise the Site Risk Level

The site risk level is categorised through a combination of habitat risk and project size which is then entered into the table matrix as shown below in Table 4-5 to calculate the overall site risk level. The full matrix table, as provided within SNH *et al.* (2019) guidance, is shown in Annex C which includes descriptions on how to determine the habitat risk and project size for the site.

Table 4-5: Initial Site Risk Assessment[3].

Site Risk Level (1-5) *	Project Size			
		Small	**Medium**	**Large**
Habitat Risk	**Low**	1	2	3
	Moderate	2	3	4
	High	3	4	5

Key: Green (1-2) – low/lowest site risk; Amber (3) – medium site risk; Red (4-5) – high/highest site risk

***** Some sites could conceivably be assessed as being of no (0) risk to bats. This assessment is only likely to be valid in more extreme environments, such as above the known altitudinal range of bats, or outside the known geographical distribution of any resident British species.

4.3.6 Step 6: Risk Assessment

The overall risk assessment is undertaken for high collision risk species identified on site and involves combining site risk level (Section 4.3.5, Table 4-5) with the Ecobat activity level (Section 4.3.1, **Error! Reference source not found.**). The overall risk assessment matrix is shown in

Table 4-6 below where Low site risk level (green) is 0-4, Medium site risk level (amber) is 5-12, and High site risk level (red) is 15-25.

Table 4-6: Overall Risk Assessment[3].

Ecobat activity category (or equivalent justified categorisation)						
Site Risk Level	**Nil (0)**	**Low (1)**	**Low-Moderate (2)**	**Moderate (3)**	**Moderate-High (4)**	**High (5)**
Lowest (1)	0	1	2	3	4	5
Low (2)	0	2	4	6	8	10
Medium (3)	0	3	6	9	12	15
High (4)	0	4	8	12	15	18
Highest (5)	0	5	10	15	20	25

4.3.7 Step 7: Assessment of Significance and Mitigation

The outputs of the risk assessment detailed in step 6 above are then used to assess the significance of effect within the Ecological Impact Assessment. At this stage other site-specific factors should be considered such as habitat characteristics (and how they may change), behaviour of species at the site, and location of the site regarding the natural range of the species and how this could affect favourable conservation status.

Mitigation measures as detailed within SNH *et al.* (2019) guidance are then considered, as appropriate.

5 BAT SURVEY LIMITATIONS

Due to no significant habitat changes since the original surveys in 2012 with no roosting bats identified during a PRA in 2012 and repeated in 2019, it was not considered necessary to undertake further bat activity surveys across the site given the species previously recorded, associated low levels of bat activity, as well as the conclusions of the Cairn Duhie Wind Farm ES (2013) assessment of a negligible and Not Significant effect on bats. Based on SNH *et al*. (2019) guidance, published since the original surveys were undertaken, the 2012 automated bat data was re-analysed using the EcoBat tool to allow for an objective measure of relative bat activity to be undertaken. SNH were consulted at the 'Scoping' stage for the Proposed Development and agreed with this assessment approach (Formal Scoping Consultation, SNH (03/04/2020 and 16/06/2020).

SNH *et al*. (2019) guidance recommends that weather data is collected along with temporal (static) data to better understand bat activity within the site and to also help inform mitigation. No weather data was collected during the 2012 surveys; however, this is not considered to be a limitation, as the surveys in 2012 were carried out under suitable weather conditions for bats following previous guidance (Hundt, 2012).

No further analysis of spatial data was completed during the preparation of this report. This is not considered to be a limiting factor as the automated surveys allowed for an appropriate sample of data to be recorded for the site, to determine the overall site risk to be calculated. Furthermore, spatial surveys are primality used to determine bat roosting and foraging activity across the site and provide additional data for the site given their focused surveying period around dusk and dawn.

Some temporal calls were assigned an unknown value (NoID), due to a very faint call or incomplete call that could not be identified to species level on the spectrogram. These were not considered further in the Ecobat analysis.

For some *Myotis* spp. calls it was only possible to identify the call to genus level. It is possible that for *Myotis* spp. these recordings could represent species not identified in the analysis of the recorded data. *Myotis* spp. bats are categorised as low collision risk species.

Anabat detectors are a commonly used bat detector for acoustic monitoring at wind farm sites, however all bat detectors have limitations and will only monitor bat activity within a limited area, which for Anabats is usually around 30m, depending on a variety of environmental factors. Furthermore, due to passive monitoring methodologies depending on sound reaching the microphone, the detection rate of bat calls varies with a bias towards loud bat calls with quieter calls, namely brown long-eared bats, potentially being under recorded.

6 SURVEY RESULTS & ANALYSIS

6.1 Desk-Based Study

NBN Atlas returned records of the following bat species within 10km of the site boundary[4]:

- Natterer's bat killed by a cat near Mid-Urchany (NH 9048) in 2018.

6.2 Preliminary Bat Roost Assessment

No trees or structures with PRFs were located within the site.

6.3 Spatial Surveys

In total three bat species and one genus classification were recorded during spatial surveys: soprano pipistrelle, common pipistrelle, pipistrelle spp. and Daubenton's bat, with a total of 1.54 bpph recorded for the site. The habitat type that recorded the most bpph was edge/scrub & road (3.15 bpph) followed by open water (2.00 bpph), open/moorland (1.37 bpph) and edge forest (1.30 bpph).

6.4 Automated Activity Surveys

MacArthur Green deployed four static detectors at four locations from May to September in 2012 over 29 nights, resulting in 113 data recording nights (see Table B-2 and B-3 of Annex B).

The survey results were processed using the Ecobat tool to gain a measure of relative bat activity at the site. The results are presented in Steps 1 – 6 below.

Between May to September 2012, bats were detected on 26 nights, using four static bat detectors, with a total of four bat species and one genus classification recorded for the site. The total number of passes recorded for each species, and the percentage of the total across all of the detectors within the site is shown below:

- Common pipistrelle: 389 passes and 21.8% of passes;
- Soprano pipistrelle: 1,323 passes and 74% of passes;
- *Myotis* bats: 41 passes and 2.3% of passes;
- Daubenton's bat: 32 passes and 1.8% of passes; and
- Brown long-eared: 3 passes and 0.2% of passes.

6.4.1 Step 1: Bat Activity Levels

Average Annual Site Activity Levels

Table 6-1 and Chart 6-1 details the average annual site activity levels calculated using the Ecobat tool (Mammal Society, 2017).

Table 6-1: Average Annual Site Activity Levels taken from Ecobat Analysis[5]

Species/Species Group	Median Percentile	95% Cis*	Max Percentile	Nights Recorded
Myotis spp.	35	35-35	68	9
Myotis Daubentonii	0	35-35	47	16
Pipistrellus pipistrellus	24	57-80	86	55
Pipistrellus pygmaeus	47	69 – 94.5	99	41
Plecotus auritus	0	0-0	0	3

*CIs: confidence intervals.

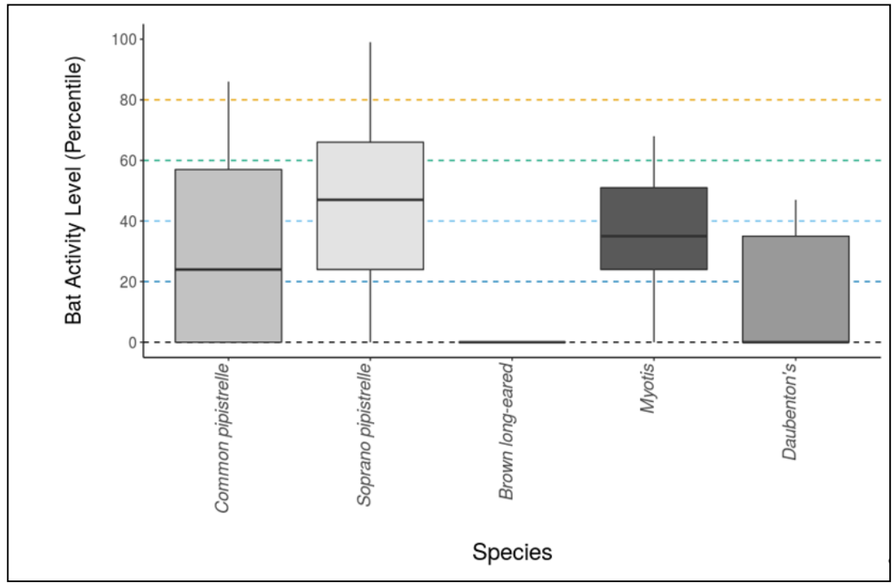

Chart 6-1: Average Annual Site Activity Levels - Box Plots[5]

Monthly Location Specific Activity Levels

Data on the monthly activity levels per location for 2012 is provided in Table D-1 of Annex D.

[4] Only NBN records from 2010 to 2020 were considered during the desk study.

[5] Taken from Ecobat analysis report created from automated activity data of the site (25/06/2020).

6.4.2 Step 2, 3 and 4: Collision Risk, Population Relative Abundance and Potential Vulnerability

Table 6-2 details the collision risk, population relative abundance, and potential vulnerability of the bat species recorded on-site.

Table 6-2: Collision Risk, Population Relative Abundance and Potential Vulnerability.

Bat Species	Collision Risk	Population Relative Abundance	Potential Vulnerability
Common pipistrelle	High	Common	Medium
Soprano pipistrelle	High	Common	Medium
Daubenton's	Low	Rarer	Low
Myotis spp.	Low	Rarer	Low
Brown long-eared	Low	Rarer	Low

6.4.3 Step 5: Categorising Site Risk Level

The site risk level is determined by project size and habitat risk (see Table 4-5). The Proposed Development consists of sixteen turbines that are over 50m in height, and so falls within the upper category of 'Medium' project size, as shown in Table 4-5 and Table C-1 of Annex C.

In terms of habitat quality for bats, no features were found to have roost potential within the site. There are small burns of different sizes, providing connectivity throughout the site and the surrounding landscape. The habitat consists of open and exposed moorland with some small areas of birch woodland, which could be used by small numbers of foraging bats. Low quality forging habitat with no roosting potential within the site, results in a habitat category of 'Low' risk for bats, in accordance with Table 4-5 and Table C-1 of Annex C.

According to Table 4-5 above and Table C-1 of Annex C, the 'Medium' project size combined with a 'Low' site risk level results in an overall site risk assessment of 'Low' (2).

6.4.4 Step 6: Risk Assessment – High Collision Risk Species Only

Figures 7.7 and 7.8 present the results of the median monthly risk assessment scores for high collision risk bat species recorded at the site (common and soprano pipistrelle bats) at each sample location. This data is also presented in Table D-1 of Annex D which also includes the maximum monthly risk assessment scores.

Table 6-3 below summarises the median and maximum monthly risk scores for the site. The overall site risk score based on median percentiles for high collision risk bat species (common and soprano pipistrelle species) is 'Low' for common pipistrelle and 'Medium' for soprano pipistrelle species. The overall site risk score based on maximum percentiles for high collision risk bat species is 'Medium' for both common and soprano pipistrelle species.

To provide an indication of how activity varied across the survey period for high collision risk species, the percentage of locations where a 'Medium' risk assessment score[6], was calculated from the medium and maximum percentiles. In total, based on the median percentiles, it was calculated that 25% of the locations surveyed in May recorded a 'Medium' risk score, followed by June (25%), July (75%), August (50%) and September (25%). The highest percentage of 'Medium' risk scores recorded during the survey period was in July (75%).

The maximum percentile scores which can be used to calculate peaks in bat activity, calculated peaks in activity during July and August with 100% and 75% of all locations surveyed recording a 'Medium' risk score, respectively.

Table 6-3: Risk Assessment Scores Based on Median and Maximum Percentiles for High Collision Risk Species

Species	Risk Assessment Score based on Median Percentile	Risk Assessment Score based on Max. Percentile
Common pipistrelle	Low (4)	Medium (10)
Soprano pipistrelle	Medium (6)	Medium (10)

6.5 Proximity of Roost Sites Based on Automated Activity Data

The Ecobat output includes an analysis of bat activity data at sample locations, referenced against the known roost emergence times for each high collision risk bat species (Russ, 2012). This indicates whether a roost site could be present in proximity to the anabat locations.

The Ecobat output did not locate any bat registrations in proximity to the anabat locations within the maternity roost emergence times (Maternity period defined as 15th June – 30th July), which indicates that it is unlikely that a maternity roost is present within close proximity of the site.

The Ecobat output did locate bat calls out with the maternity period before the upper time of the species-specific emergence time range, and which therefore may potentially indicate the presence of a nearby roost for soprano pipistrelle at location 3 in May and September, and for Daubenton's at location 4 in May.

[6] The median and maximum percentiles did not record a 'high' risk assessment score for the site.

7 REFERENCES

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ANNEX A. PROTECTED SPECIES LEGAL STATUS

All bat species receive protection under the Conservation Regulations (1994) (as amended).

The information contained in this Annex is a summarised version of the legislation and should be read in conjunction with the appropriate legislation.

It is an offence to:

- Deliberately or recklessly to capture, injure or kill a wild animal of a European protected species;
- Deliberately or recklessly:
  - Harass a wild animal or group of wild animals of a European protected species;
  - Disturb such an animal while it is occupying a structure or place which it uses for shelter or protection;
  - Disturb such an animal while it is rearing or otherwise caring for its young;
  - To obstruct access to a breeding site or resting place of such an animal, or otherwise to deny the animal use of the breeding site or resting place (i.e. roost sites);
  - 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; or
  - 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 damage or destroy a breeding site or resting place of such an animal.

Table A-1 Legal and Conservation Status of all UK Bats[7]

Species	Legislation / Convention													
	Bern Convention Appendix II	Bonn Convention Appendix II	WCA	Habitats Directive Annex IV	Habitats Directive Annex II	Habs Regs 1994 (as amended) *Scotland*	Conservation of Habs & Species Regs 2010	Conservation Regs (N Ireland) 1995	CROW Act 2000	NERC Act 2006	Wild Mammals Protection Act	UK BAP Priority species	IUCN Red List*	EUROBATS Agreement
Greater horseshoe bat	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	LC	✓
Lesser horseshoe bat	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	LC	✓
Daubenton's bat	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓
Natterer's bat	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓
Whiskered bat	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓
Brandt's bat	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓
Bechstein's bat	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NT	✓
Alcathoe bat	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		DD	✓
Noctule	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	LC	✓
Leisler's bat	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓
Serotine	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓
Common pipistrelle	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓
Soprano pipistrelle	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	LC	✓
Nathusius' pipistrelle	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓
Brown long-eared bat	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	LC	✓
Grey long-eared bat	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓
Barbastelle	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NT	✓
Greater mouse-eared bat	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓

*IUCN categories: LC is Least Concern, NT is Near Threatened, DD is Data deficient; see www.iucnredlist.org for more details.

[7] Source: Bat Conservation Trust http://www.bats.org.uk/pages/bats_and_the_law.html

ANNEX B. SURVEY TIMINGS & ANABAT LOCATIONS

Table B-1 Summary of Spatial Survey Effort

Survey Date	Transect	Duration
April 30/04/12 – May 01/05/12 – Dusk	1	4hrs 28 mins
	2	3hrs 40 mins
May 24/05/12 – Dawn	1	4hrs 33 mins
	2	3hrs 52 mins
June 28-29/06/12 – Dusk	1	4hrs 41 mins
	2	4hrs 05 mins
July 26-27/07/12 – Dusk	1	4hrs 56 mins
	2	3hrs 42 mins
August 27-28/08/12 – Dusk	1	6hrs 39 mins
	2	4hrs 16 mins
September 27-28/09/12 – Dawn	1	4hrs 51 mins
	2	4hrs 05 mins
Total	-	**53 hrs 48 mins**

Table B-2 Summary of Temporal Survey Effort

Survey Date	Survey Locations	Total Number of Complete Nights
May 01/05/12 – May 07/05/12	1	4
	2	5
	3	5
	4	5
May 24/05/12 – May 30/05/12	1	5
	2	4
	3	4
	4	5
June 28/06/12 – July 02/07/12	1	4
	2	4
	3	4
	4	4
July 26/07/12 – July 31/07/12	1	6
	2	6
	3	5
	4	5
August 28/08/12 – September 02/09/12	1	4
	2	4
	3	5
	4	5
September 27/09/12 – October 01/10/12	1	4
	2	4
	3	4
	4	4
Total	-	**113**

Table B-3 Description of Anabat Locations

Location	Latitude	Longitude	Habitat
1	57.474499	-3.705585	Open Moorland
2	57.469026	-3.693437	Stream/burn
3	57.453183	-3.706684	Edge/birch woodland
4	57.443857	-3.694254	Open/Lochan Tutach

ANNEX C. INITIAL SITE RISK ASSESSMENT

Table C-1 Initial Site Risk Assessment[8].

Site Risk Level (1-5)[9]	Project Size			
Habitat Risk		Small	Medium	Large
	Low	1	2	3
	Moderate	2	3	4
	High	3	4	5
Key: Green (1-2) – low/lowest site risk; Amber (3) – medium site risk; Red (4-5) – high/highest site risk				

Habitat Risk	Description
Low	Small number of potential roost features, of low quality. Low quality forging habitats that could be used by small numbers of foraging bats. Isolated site not connected to the wider landscape by prominent linear features.
Moderate	Buildings, trees or other structures with moderate-high potential as roost sites on or near the site. Habitat could be used extensively by foraging bats. Site is connected to the wider landscape by linear features such as scrub, tree lines and streams.
High	Numerous suitable buildings, trees (particularly mature ancient woodland) or other structures with moderate-high potential as roost sites on or near the site, and/or confirmed roosts present close to or on the site. Extensive and diverse habitat mosaic of high quality for foraging bats. Site is connected to the wider landscape by a network of strong liner features such as rivers, blocks of woodland and mature hedgerows. At/near edge of range and or an important flyway. Close to key roost and /or swarming.

Project Size	Description
Small	Small scale development (<10 turbines). No other wind energy developments within 10km. Comprising turbines <50m in height.
Medium	Larger developments (between 10 and 40). May have some other wind development within 5km. Comprising turbines 50 – 100m in height.
Large	Largest developments (>40 turbines) with other wind energy developments within 5km. Comprising turbines >100m in height.

[8] Sourced from: Scottish Natural Heritage, Natural England, Natural Resources Wales, Renewable UK, Scottish Power Renewables, Ecotricity Ltd, the University of Exeter & Bat Conservation Trust (BCT). (2019). *Bats and Onshore Wind Turbines: Survey Assessment and Mitigation.*

[9] Some sites could conceivably be assessed as being of no (0) risk to bats. This assessment is only likely to be valid in more extreme environments, such as above the known altitudinal range of bats, or outside the known geographical distribution of any resident British species.

ANNEX D. MONTHLY LOCATION SPECIFIC DATA

Table D-1 Monthly Location Specific Data for High Collision Risk Species

Location ID	Species	Month	Median Percentile	Median Activity Category (Taken from Table 4-1)	Maximum Percentile	Maximum Activity Category (Taken from Table 4-1)	Site Risk (Taken from Table 4-5)	Overall Median Category (Taken from Table 4-6)	Overall Maximum Category (Taken from Table 4-6)
1	*Pipistrellus pipistrellus*	May	57	Moderate	71	Moderate-High	2	**Medium**	**Medium**
1	*Pipistrellus pipistrellus*	Jun	71	Moderate-High	71	Moderate-High	2	**Medium**	**Medium**
1	*Pipistrellus pipistrellus*	Jul	84	High	86	High	2	**Medium**	**Medium**
1	*Pipistrellus pipistrellus*	Aug	64	Moderate-High	80	Moderate-High	2	**Medium**	**Medium**
1	*Pipistrellus pipistrellus*	Sep	26	Low-Moderate	51	Moderate	2	**Low**	**Medium**
1	*Pipistrellus pygmaeus*	May	0	Low	0	Low	2	**Low**	**Low**
1	*Pipistrellus pygmaeus*	Jun	0	Low	0	Low	2	**Low**	**Low**
1	*Pipistrellus pygmaeus*	Jul	0	Low	64	Moderate-High	2	**Low**	**Medium**
1	*Pipistrellus pygmaeus*	Aug	67	Moderate-High	73	Moderate-High	2	**Medium**	**Medium**
1	*Plecotus auritus*	May	0	Low	0	Low	2	**Low**	**Low**
1	*Plecotus auritus*	Jul	0	Low	0	Low	2	**Low**	**Low**
2	*Myotis*	Jul	35	Low-Moderate	35	Low-Moderate	2	**Low**	**Low**
2	*Myotis daubentonii*	Jul	0	Low	47	Moderate	2	**Low**	**Medium**
2	*Pipistrellus pipistrellus*	May	0	Low	0	Low	2	**Low**	**Low**
2	*Pipistrellus pipistrellus*	Jun	0	Low	0	Low	2	**Low**	**Low**
2	*Pipistrellus pipistrellus*	Jul	0	Low	41	Moderate	2	**Low**	**Medium**
2	*Pipistrellus pipistrellus*	Aug	35	Low-Moderate	69	Moderate-High	2	**Low**	**Medium**
2	*Pipistrellus pipistrellus*	Sep	24	Low-Moderate	24	Low-Moderate	2	**Low**	**Low**
2	*Pipistrellus pygmaeus*	Jul	24	Low-Moderate	24	Low-Moderate	2	**Low**	**Low**
2	*Pipistrellus pygmaeus*	Aug	12	Low	24	Low-Moderate	2	**Low**	**Low**
3	*Myotis*	Sep	46	Moderate	68	Moderate-High	2	**Medium**	**Medium**
3	*Myotis daubentonii*	Jul	0	Low	0	Low	2	**Low**	**Low**
3	*Myotis daubentonii*	Sep	35	Low-Moderate	47	Moderate	2	**Low**	**Medium**
3	*Pipistrellus pipistrellus*	May	24	Low-Moderate	24	Low-Moderate	2	**Low**	**Low**

Location ID	Species	Month	Median Percentile	Median Activity Category (Taken from Table 4-1)	Maximum Percentile	Maximum Activity Category (Taken from Table 4-1)	Site Risk (Taken from Table 4-5)	Overall Median Category (Taken from Table 4-6)	Overall Maximum Category (Taken from Table 4-6)
3	*Pipistrellus pipistrellus*	Jul	44	Moderate	83	High	2	**Medium**	**Medium**
3	*Pipistrellus pipistrellus*	Aug	21	Low-Moderate	41	Moderate	2	**Low**	**Medium**
3	*Pipistrellus pipistrellus*	Sep	35	Low-Moderate	71	Moderate-High	2	**Low**	**Medium**
3	*Pipistrellus pygmaeus*	May	28	Low-Moderate	55	Moderate	2	**Low**	**Medium**
3	*Pipistrellus pygmaeus*	Jul	83	High	93	High	2	**Medium**	**Medium**
3	*Pipistrellus pygmaeus*	Aug	96	High	98	High	2	**Medium**	**Medium**
3	*Pipistrellus pygmaeus*	Sep	92	High	99	High	2	**Medium**	**Medium**
4	*Myotis daubentonii*	May	12	Low	24	Low-Moderate	2	**Low**	**Low**
4	*Myotis daubentonii*	Jul	24	Low-Moderate	35	Low-Moderate	2	**Low**	**Low**
4	*Myotis daubentonii*	Aug	0	Low	0	Low	2	**Low**	**Low**
4	*Myotis daubentonii*	Sep	0	Low	0	Low	2	**Low**	**Low**
4	*Pipistrellus pipistrellus*	May	24	Low-Moderate	62	Moderate-High	2	**Low**	**Medium**
4	*Pipistrellus pipistrellus*	Jun	12	Low	24	Low-Moderate	2	**Low**	**Low**
4	*Pipistrellus pipistrellus*	Jul	57	Moderate	80	Moderate-High	2	**Medium**	**Medium**
4	*Pipistrellus pipistrellus*	Aug	0	Low	24	Low-Moderate	2	**Low**	**Low**
4	*Pipistrellus pipistrellus*	Sep	0	Low	24	Low-Moderate	2	**Low**	**Low**
4	*Pipistrellus pygmaeus*	May	38	Low-Moderate	62	Moderate-High	2	**Low**	**Medium**
4	*Pipistrellus pygmaeus*	Jun	33	Low-Moderate	41	Moderate	2	**Low**	**Medium**
4	*Pipistrellus pygmaeus*	Jul	58	Moderate	74	Moderate-High	2	**Medium**	**Medium**
4	*Pipistrellus pygmaeus*	Sep	24	Low-Moderate	24	Low-Moderate	2	**Low**	**Low**

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Cairn Duhie Wind Farm

Appendix 7.4

Outline Habitat Management Plan

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1 INTRODUCTION

This Outline Habitat Management Plan (OHMP) describes the proposed habitat management at Cairn Duhie Wind Farm, near Ferness, approximately 15km south-east of Nairn (hereafter referred to as the 'Proposed Development').

This OHMP sets out in the following sections the:

- Proposed Habitat Management Units;
- Aims, objectives and management prescriptions;
- Monitoring programme; and
- Management and monitoring timetable.

The key habitats and species addressed are blanket bog, wet dwarf shrub heath, and upland waders (such as curlew, golden plover and lapwing).

The management recommended within this OHMP is based on the findings of the baseline surveys and ecology and ornithology assessments within the Cairn Duhie Wind Farm Environmental Impact Assessment (EIA) Report.

EIA Report Chapter 7: Ecology concludes no significant unmitigated effects on important ecological features; however, measures to maintain and enhance blanket bog and wet dwarf shrub heath habitats are proposed, as these habitats are subject to direct habitat loss due to infrastructure.

EIA Report Chapter 8: Ornithology of the EIA Report concludes no significant unmitigated effects on important ornithological features at the site; however, a number of wader species of conservation concern have been recorded at the site, and habitat management is proposed to maintain and enhance suitable mosaic habitats for these species. Furthermore, the maintenance and enhancement of blanket bog and wet heath habitats would have subsequent secondary benefits for local fauna, such as the sites upland bird assemblage and the aforementioned wader species.

A final HMP, which will include the confirmed Habitat Management Area (HMA) and associated Habitat Management Units (HMU) where the Aims will apply, will be agreed with The Highland Council (THC) in consultation with NatureScot[1] prior to the commencement of construction.

The OHMP has been developed based on the available ecological information for the site. The collection of further data during the pre-construction period, or feedback and consultation with relevant consultees, could lead to the consideration of alternative or amended HMUs, or habitats or species targeted for restoration or enhancement, in preparation of the final HMP.

[1] Formerly Scottish Natural Heritage (SNH).

2 HABITAT MANAGEMENT UNITS

The OHMP area comprises three potential HMUs (A, B and C) within which management will be implemented in suitable habitat within these areas. Further details on each area are provided below and summarised in Table 2-1; Figure 7.9 provides the locations of these outline areas.

2.1 Habitat Management Unit A

HMU A covers an area of 73.7 hectares (ha) in the north-east of the site (Figure 7.9).

This area is enclosed by an existing fence line and is predominately comprised of blanket bog habitats. Overall, the blanket bog habitats within the site, whilst not pristine and partially degraded to varying degrees, does contain a moderate coverage of Sphagna and other peat forming species which would indicate the majority of the bog continues to be active and in moderate condition. However, a number of areas have evidently been anthropogenically impacted in the past through historical drainage and peat cutting, burning and grazing may also have occurred in the past. A full detailed description of the habitats within the site is provided in Technical Appendix 7.1).

Within HMU A, there are also a few small patches of other habitats such as wet and dry heath, and an area of flush surrounding the Stripe of Muckle Lyne watercourse. The area also contains a small coupe of plantation woodland and scattered self-seeded conifer trees. Aerial imagery indicates the presence of historical moor grip drainage of the blanket bog to the east of the Stripe of Muckle Lyne within this HMU (see Figure 7.9).

The management of this HMU will be primarily for blanket bog maintenance, restoration and enhancement. Enhancement of blanket bog here will also likely have secondary benefits for upland waders locally in terms of providing a habitat mosaic with wetter habitats and potentially a more varied vegetation sward for breeding and foraging. Additionally, drain blocking will prevent wader chicks from getting trapped in such features. These secondary benefits will tie in with the aims and proposed management of adjacent HMU C, described further below.

2.2 Habitat Management Unit B

HMU B covers an area of 34.7ha in the south of the site (Figure 7.9).

The eastern section of this HMU is dominated by blanket bog habitat which is divided by a strip of flush vegetation following the course of a minor first order watercourse. Aerial imagery indicates the presence of historical moor grip drainage in this area of blanket bog (see Figure 7.9). The western section of this HMU is a mosaic of blanket bog and wet heath habitat.

The management of this HMU will be primarily for blanket bog and wet heath maintenance, restoration and enhancement. Enhancement of blanket bog and wet heath here will also likely have secondary benefits for upland waders, black grouse and raptors that may be present at the site.

2.3 Habitat Management Unit C

HMU C covers an area of 23.4ha in the north of the site (Figure 7.9).

This area is enclosed by existing fence lines and comprises a varied upland habitat mosaic which includes areas of blanket bog, wet heath, marshy grassland, acid grassland, basin mire and a small pond. The main concentration of breeding activity by upland warders recorded during baseline surveys was also clustered towards, and includes, this area (see Figure 8.12 of Chapter 8: Ornithology).

The management of this HMU will be primarily for maintaining and enhancing existing mosaic habitats for the benefit of the local breeding and wintering wader assemblage.

Table 2-1 Management Units

HMU	Primary Aim	Area (ha)
A	Maintain, restore, and enhance blanket bog.	73.7
B	Maintain, restore, and enhance blanket bog and wet heath.	34.7
C	Enhance the mosaic of upland wader breeding and foraging habitat.	23.4
	Total HMP Area	**131.8ha**

3 AIMS, OBJECTIVES AND MANAGEMENT PRESCRIPTIONS

The Aims define the general OHMP goals and the related Objectives further define the Aims into quantifiable targets. The Prescriptions detail the management works to be implemented to achieve these Aims and Objectives. Annex A below provides an indicative timetable for the implementation of the various Prescriptions.

Aim 1 **Maintain, restore, and enhance the blanket bog resource across Management Unit A**

Objective 1.1 Increase the abundance, diversity and distribution of major peat forming species, particularly *Eriophorum* spp. and Sphagna (especially broad-branched species such as *Sphagnum papillosum*).

Objective 1.2 Increase the abundance and diversity of dwarf shrubs such as *Calluna vulgaris, Erica tetralix, Empetrum nigrum* and *Vaccinium* spp. in line with local reference blanket bog.

Objective 1.3 Limit encroachment of self-seeding conifers, and no self-seeded conifers more than 0.5m in height after 5 years.

Prescription 1.1 Dam moor grips/drains in order that the water level is raised sufficiently to create more favourable conditions suitable for the species mentioned within Objective 1.1.

Prescription 1.2 Repair, maintain or re-establish the existing fence enclosing HMU A. If new fencing is required these will follow guidelines in Trout & Kortland (2012)[2] to minimise collision risks for black grouse. If grazed, then sheep grazing densities will apply within the HMU as per below.

	Maximum	Minimum
1st April -30th September	0.10 LU/ha*	0.05 LU/ha
1st October-31st March	0.05 LU/ha	0.00 LU/ha

*Livestock Unit per hectare

Prescription 1.3) The following activities will be prohibited within the area being managed for blanket bog:

- Clearing out of any existing ditches.
- Application of any insecticides, fungicides or molluscicides.
- Application of lime or any other substance to alter the soil acidity.
- Cut or top vegetation except to control injurious weed species.
- Burn vegetation or other materials.
- Use of roll or chain-harrow.
- Supplementary livestock feeding.
- Planting trees.
- Carry out any earth moving activities.
- Use for off-road vehicle activities with the exception of limited quad bike use for agricultural activities.
- Construct tracks, roads, yards, hardstandings or any new structures.
- Storage of materials or machinery.

Prescription 1.4) Remove self-seeded conifers from the HMU annually, by hand if possible, until a time that monitoring shows that conifer encroachment is no longer an issue or frequency of intervention can be reduced.

Aim 2 **Maintain, restore, and enhance the blanket bog and wet heath resource across Management Unit B**

Objective 2.1 Objectives 1.1 and 1.2 (for blanket bog) and Objective 1.3 apply for HMU B also.

Objective 2.2 Increase the abundance and diversity of dwarf shrubs such as *Calluna vulgaris*, *Erica tetralix*, *Empetrum nigrum* and *Vaccinium* spp. in line with local reference wet heath.

Objective 2.3 Increase the abundance, diversity, and distribution of *Sphagnum* mosses common in wet heaths, particularly species such as *Sphagnum capillifolium*.

Prescription 2.1) Prescriptions 1.1 to 1.4 apply to HMU B also.

Prescription 2.2) Fence off HMU B from livestock, if required, to facilitate grazing management as per Prescription 1.2.

Aim 3 **Enhance the mosaic of upland wader breeding and foraging habitat within Management Unit C**

Objective 3.1 Create, or enhance, suitable nesting and chick-rearing and foraging mosaic habitat for waders within HMU C.

Prescription 3.1) Repair, maintain or re-establish the existing fence enclosing HMU C. If new fencing is required these will follow guidelines in Trout & Kortland (2012)[2] to minimise collision risks for black grouse.

Prescription 3.2) Stock will be excluded and grazing prohibited from 15th March to 30th June annually within HMU C. After 30th June stock may graze the area until exclusion the following spring. Fencing and stock management will prevent nest trampling and disturbance from livestock during the breeding bird season, whereas the grazing management will also allow manipulation of sward height and density, adding to habitat heterogeneity and mosaics.

Prescription 3.3) The area must be grazed in the accessible period. The aim is to graze the sward down to remove annual growth to avoid a build-up of matted dead plant material. The sward may still contain occasional tussocks or patches of taller vegetation.

Prescription 3.4 Manage vegetation within the acid grassland and marshy grassland sections of HMU C with the aim of achieving 10-30% scattered rush cover, and grass in the region of 20-30cm in height, in advance of the breeding bird season (i.e. prior to March). This prescription will not apply to areas of blanket bog, wet heath or basin mire within HMU C.

Prescription 3.5) No mowing or cutting of vegetation within the HMU. However, if subsequent monitoring indicates there are large areas within HMU C where the sward is considered too tall or dense then some limited cutting or mowing may be undertaken in a random pattern outwith the breeding bird season and exclusion period to maintain a mosaic of habitats and diverse sward structure under the instruction of an ecologist, and as per Prescription 3.4 above.

[2] Trout, R. and Kortland, K. (2012). Fence marking to reduce grouse collisions. Forestry Commission Technical Note.

Prescription 3.6) Dam any active drains or gullies in order that the water level is raised to create some patches of wetter habitat with the HMU and prevent wader chicks from getting trapped.

Prescription 3.7) Create two to three 'wader scrapes' within the HMU to attract and increase insect availability for foraging or chick rearing waders. Scrapes are shallow depressions with gently sloping edges, which will hold water during spring and early summer when waders are nesting and rearing chicks. Each scrape will be positioned in a suitably wet hollow location and will be a minimum of $25m^2$ in size. Exact locations will be refined on site by an ecologist at the time of construction depending on local ground conditions and suitability.

Prescription 3.8) Prohibition of the activities described within Prescription 1.3 above, except for mowing if required as part of Prescriptions 3.4 and 3.5 above.

4 MONITORING

Monitoring will establish whether or not the proposed management prescriptions are achieving the various Aims and Objectives and in turn will inform adaptive management to ensure the Aims and Objectives are achieved through the life of the HMP.

4.1 Habitat Monitoring

4.1.1 HMU A & B

Habitat monitoring will evaluate the maintenance, restoration and enhancement of blanket bog and wet heath habitat types by recording changes to the structure of the vegetation and species abundance, evenness and diversity.

A representative sample of fixed vegetation quadrats will be established within HMU A and HMU B to gather sufficient data on baseline condition and progress and to inform future management. The survey would be carried out during the flowering season and repeat surveys would be carried out in the same month in each monitoring year to gather comparable data. Photographs would also be taken of each sample quadrat, as well as overview photographs of each Management Unit.

A measure of conifer regeneration will also form part of the monitoring proposal, as will monitoring the success of any drain blocking undertaken. The final detailed methods will be agreed with SNH.

Habitat monitoring will commence in year 1 of operation of the Proposed Development to establish the baseline and then will be repeated in years 3, 5, 10 and 15 of the operational phase of the wind farm. The frequency of monitoring thereafter will be agreed in consultation with SNH.

4.1.2 HMU C

The sward height will be monitored across HMU C to determine if a suitable swards and mosaics exist to fulfil Aim 3 above. This will involve monitoring the sward height at evenly distributed points along pre-determined transects of the HMU. In addition, notes will be made on general observations of the sward and habitat mosaic, and whether excessive dead material or leaf litter is building up. This data will be used to determine whether grazing levels need to be increased or decreased within HMU C during the accessible period and whether any grass/rush cutting/mowing is required to fulfil Aim 3 in subsequent years.

Sward monitoring will commence in year 1 of operation of the Proposed Development to establish the baseline and then will be repeated in years 3, 5, 10 and 15 of the operational phase of the Proposed Development. The frequency of monitoring thereafter will be agreed in consultation with SNH.

4.2 Breeding Bird Monitoring

A four-visit upland Breeding Bird Survey (BBS) will be completed in years 1, 2, 3, 5, 10 and 15 during the operational phase of the Proposed Development.

The main objective of this monitoring will be to assess changes in wader activity levels by recording numbers and distribution of breeding waders within HMU C (plus 500m buffer) and also HMUs A and B. However, all breeding birds observed will be recorded, including ground nesting passerines such as skylark and meadow pipit to determine whether the management for waders is also having a positive effect on all locally present ground nesting birds. The presence of any raptors or black grouse will also be recorded.

5 REPORTING

Reports will be submitted to The Highland Council and SNH in years 1, 2, 3, 5, 10 and 15. The report would detail management works completed to date and works proposed over the next reporting period. The habitat monitoring report and breeding bird survey report will be appended.

6 HMP TIMETABLE

Annex A below provides an indicate management and monitoring timetable for the first 15 years of operation of the Proposed Development.

ANNEX A. MANAGEMENT AND MONITORING TIMETABLE

Item	Year 1[3]	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15…
Repair, maintain or re-establish fences as required for each HMU	X														
Drain/moor grip blocking (HMU A & B)	X														
Dam any active drains or gullies to create wet areas (HMU C)	X														
Create wader scrapes (HMU C)	X														
Removal of self-seeded conifers, as required (HMU A & B)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Grazing/livestock management	Throughout lifetime of HMP														
Excluded activities	Apply throughout the operational phase of the Proposed Development and lifetime of the HMP														
Habitat, drain blocking, conifer, and sward monitoring	X		X		X					X					X
Breeding bird monitoring	X	X	X		X					X					X
Reporting to THC and NatureScot	X		X		X					X					X

[3] Year 1 equates to the first year of operation following final commissioning of the Proposed Development.