MacArthur Green

ARECLEOCH WINDFARM EXTENSION

National Vegetation Classification & Habitats Survey

Technical Appendix 8.1

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Prepared by:	Jason Mackay, ACIEEM
Reviewed by:	Brian Henry, MCIEEM
Date:	15/02/2019
Tel:	0141 342 5404
Address:	93 South Woodside Road | Glasgow | G20 6NT

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EXECUTIVE SUMMARY

MacArthur Green was commissioned by ScottishPower Renewables (SPR) to carry out a National Vegetation Classification (NVC) and habitats survey at the proposed Arecleoch Windfarm Extension, approximately 2.5 km south-west of Barrhill, South Ayrshire (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 and respective study area in order to identify those areas of greatest ecological interest (i.e. Annex I habitats; potential Groundwater Dependent Terrestrial Ecosystems (GWDTE), and Scottish Biodiversity List (SBL) priority habitats). This information is used to inform the windfarm design process and the ecological assessment for the proposed Development's Environmental Impact Assessment Report (EIAR).

Surveys were conducted from 13 to 17 July 2015, 27 to 31 July 2015 and 4 to 6 July 2018 inclusive by MacArthur Green. In total 29 NVC communities were recorded in the study area along with various associated sub-communities, however only a small number of communities accounted for the majority of the study area.

The majority of the study area is dominated by commercial conifer plantation. Outwith these forestry areas, in openings and forest rides, the most common and widespread semi-natural communities are M25 *Molinia caerulea – Potentilla erecta* mire, M23 *Juncus effusus/acutiflorus – Galium palustre* rush-pasture and M6 *Carex echinata – Sphagnum fallax/denticulatum* mire. The remainder of the study area is made up of a relatively small number of mainly mire, grassland, woodland and heath communities. It is also clear from the vegetation communities present and their composition that many habitats have been heavily influenced by anthropogenic interaction, with the single largest factor being the presence of widespread commercial conifer plantation and its associated drainage, drying and shading effects.

The survey results have also been compared to a number of sensitivity classifications, indicating the presence of Annex I, SBL and potential GWDTE habitats.

1 INTRODUCTION

MacArthur Green was commissioned by ScottishPower Renewables (SPR) to carry out a National Vegetation Classification (NVC) and habitats survey at the proposed Arecleoch Windfarm Extension, approximately 3 km south west of Barrhill, South Ayrshire (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 and respective study area in order to identify those areas of greatest ecological interest (i.e. Annex I habitats[1]; potential Groundwater Dependent Terrestrial Ecosystems (GWDTE)[2]; and Scottish Biodiversity List (SBL) priority habitats).

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

2 THE SITE AND STUDY AREA

The Site extends across Arecleoch Forest adjacent to the operational Arecleoch Windfarm, by Barrhill, South Ayrshire.

The Site has a typical upland habitat assemblage for the local area and is dominated by coniferous plantation with large areas of re-colonising clear-fell in advance of second rotation replanting. The Site reaches an elevation of 230 m a.s.l. around Shiel Hill, within the north of the Site. The NVC survey focussed on mapping the habitats within the Site and buffers as necessary (hereinafter referred to as the 'study area' – see Figure 8.3).

Large sections of the study area are covered in mature and semi-mature *Picea sitchensis* commercial forestry. The remainder of the study area is dominated by clear-fell areas in various stages of vegetative recovery prior to replanting. The forest rides, together with the unplanted or un-forested habitats, are generally over mire and grassland communities. A number of watercourses dissect and drain the study area. The study area is bisected by the minor road, which runs between the village of Barrhill and the village of New Luce, along with a section of the Glasgow South Western railway line. Much of the study area has been impacted anthropogenically over time in a number of ways, mainly through past grazing, drainage and forestry plantation, which has greatly influenced plant communities in areas.

The study area does not overlap with any designated sites for which there are botanical or habitat related qualifying features.

3 METHODOLOGY

The vegetation was surveyed by two 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 1:5000 aerial imagery field maps. These polygons were surveyed qualitatively to record dominant

[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'.

[2] As defined within SEPA (2017). Guidance Note 31: Guidance on Assessing the Impacts of Windfarm Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems. Available for download from http://www.sepa.org.uk/media/143868/lupsgu31_planning_guidance_on_groundwater_abstractions.pdf.

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 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.

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

4 SURVEY CONSTRAINTS & CONSTRAINTS

The NVC surveys were carried out from 13 to 17 July 2015, 27 to 31 July 2015 and 4 to 6 July 2018 inclusive, during the optimal season for habitat surveys. Surveys were carried out by two surveyors over this period. The weather conditions were amenable to survey with mixed weather conditions over the survey period. Some small sections of the study area were directly inaccessible and could not be surveyed in detail, or were surveyed from a suitable vantage point e.g. railway track embankments; however, these constraints are not considered to affect the validity of the survey results, or the robustness of any assessments made from these data, as detailed below.

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 1980s 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 this project 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 NVC SURVEY RESULTS AND VEGETATION DESCRIPTIONS

5.1 Summary of NVC Communities

The categories of vegetation within the study area include the following 29 NVC communities recorded during the survey:

- Mires and flushes: M2, M3, M4, M6, M17, M19, M20, M23, M25, M27, M28;
- Wet heaths: M15;
- Dry heaths: H9, H10, H12;
- Grasslands and bracken: U2, U4, U20; MG1, MG9, MG10;
- Woodland and scrub: W4, W7, W11, W21, W23;
- Swamp and tall-herb fens: S12, S28; and
- Vegetation of open habitats: OV27.

The following sections describe the flora, structure and habitats of these communities and any associated observed sub-communities, as found within this study area. For each NVC community description, the first paragraph refers to the community in Britain or Scotland as a whole, before moving on to the other paragraphs which describe the vegetation as it was found to occur within this study area. The NVC communities within each broad habitat type (e.g. woodland) are described in order of community number within the study area.

The survey results are displayed in Figure 8.3. A number of target notes were also made during surveys, often to pinpoint areas or species of special interest. These target notes are shown in Figure 8.3 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 Mires and Flushes

5.2.1 M2 Sphagnum cuspidatum/fallax bog pool community

Communities/sub-communities recorded: M2a

This community is typically found in pools and lawns on the surface of very wet and base-poor peats on ombrogenous and topogenous mires in the less oceanic parts of Britain (Rodwell *et al* 1991; Elkington *et al* 2001; Averis *et al* 2004). M2 is typically dominated by soft wet carpets of *Sphagnum cuspidatum* or *S. fallax*, or both. This community has been reduced by widespread drainage and cutting of mires, so that often just small and modified fragments remain within predominantly agricultural landscapes. However, this community also readily colonises shallow flooded workings (Rodwell *et al* 1991; Elkington *et al* 2001).

A single area of M2 was recorded within the south west of the study area. This area was found within a mosaic along the fringes of a pond along with the M28 *Iris pseudacorus – Filipendula ulmaria* mire community (see section 5.2.11 below). The stand was composed of *Rhynchospora alba* with no other associates and as such was mapped as the M2a *Rhynchospora alba* sub-community. The moss cover was very limited with occasional patches of *Sphagnum fallax*.

5.2.2 M3 Eriophorum angustifolium bog pool community

The M3 community is typically found as small stands on barer exposures of acid peat in depressions, erosion channels or shallow peat cuttings on a wide range of mire types but especially among the M19 *Calluna vulgaris – Eriophorum vaginatum* and M20 *Eriophorum vaginatum* mires (Rodwell *et al* 1991; Elkington *et al* 2001). It can occur in permanently flooded pools and natural hollows on surfaces of more or less intact mires, and on dried-up hollows and among erosion features where the peat has been worn down in gullies or redistributed (Rodwell *et al* 1991; Elkington *et al* 2001; Averis *et al* 2004). The typical species, *Eriophorum angustifolium*, can occur as dense and often tall swards, but equally commonly it occurs as sparser shoots scattered over expanses of bare peat (Averis *et al* 2004).

A number of small bog pools were found within the study area, many of which were found along the disturbed areas of road verges within areas of wet heath (see TN's 4-7, 13 and Photo B-2). *Eriophorum angustifolium* is strongly dominant although *Eriophorum vaginatum* does appear in places along with *Deschampsia flexuosa*. Additional associates present include *Narthecium ossifragum*, *Erica tetralix*, and, in the richer examples of the community, *Drosera rotundifolia*.

Sphagnum mosses are often abundant with a mix of *Sphagnum fallax, S. capillifolium*, *S. cuspidatum*, *S. papillosum*, and *S. magellanicum* recorded.

5.2.3 M4 Carex rostrata - Sphagnum fallax mire

The M4 community is characteristic of pools and seepage areas on peat soils of topogenous and soligenous mires where the waters are fairly acid and only slightly enriched. It can occur in bog pools on the surface of basin mires but is more common in obviously soligenous areas as in mire laggs and the wettest parts of water-tracks (Rodwell *et al* 1991; Elkington *et al* 2001). This mire typically has a cover of sedges over a carpet of semi-aquatic *Sphagnum* spp.

M4 is infrequent within the study area, where it does appear often marking the passage and localised ponding of surface water in depressions. It is often in mosaics with other similar communities such as M6 *Carex echinata - Sphagnum fallax/denticulatum* mire and M25 *Molinia caerulea – Potentilla erecta* mire (see sections 5.2.4 and 5.2.9). M4 within the study area is typically dominated by *Carex rostrata* (exclusively so in some stands) over a carpet of *Sphagnum fallax* with lesser amounts of *S. palustre* and *Polytrichum commune.*

5.2.4 M6 Carex echinata - Sphagnum fallax/denticulatum mire

Communities/sub-communities recorded: M6, M6c, M6d

This mire is the major soligenous community of peats and peaty gleys irrigated by base poor waters in the sub-montane zone of northern and western Britain. It typically occurs as small stands among other mire communities, grasslands and heaths, and is sometimes found with swamp and spring vegetation. It is commonly found in tracts of unenclosed pasture on upland fringes, particularly between 200 m and 400 m (although it may also be found much higher) and is ubiquitous in the upland fringes of Britain (Rodwell *et al* 1991; Elkington *et al* 2001). The M6 community has a distinct general character but includes a wide variation in species composition, expressed as four sub-communities (two of which are visually similar to the M23 community). It is essentially a poor-fen with small sedges or rushes dominating over a carpet of oligotrophic and base-intolerant *Sphagna* (Rodwell *et al* 1991; Elkington *et al* 2001).

M6 is widespread and common throughout the study area as small flushed features, runnels or soakaways, and larger extensive stands; it is one of the most common communities within the study area. The community flanks many of the watercourses and drainage channels throughout the study area. Two M6 sub-communities define the character of the vegetation present, these are two rush dominated sub-communities; M6c *Juncus effusus* sub-community and M6d *Juncus acutiflorus* sub-community (see Annex C, photograph C-2) – both are widespread.

In each of the sub-communities either *J. effusus* or *J. acutiflorus* make up the bulk of the vegetation in a tall sward over a lawn of *Sphagnum fallax*, *S. palustre* and *Polytrichum commune*. In many stands there is often little more than these species listed with associates often infrequent and species diversity very low. Other occasional to rare associates that enrich the sward to varying levels in patches include *Juncus squarrosus, Agrostis* spp., *Deschampsia cespitosa*, *D. flexuosa*, *Holcus lanatus*, *Erica tetralix*, *Molinia caerulea*, *Myrica gale, Rumex acetosa, Cirsium palustre, Carex rostrata*, *C. nigra*, *Galium saxatile*, *Potentilla erecta* and *Ajuga reptans*. Additional bryophytes noted include *Sphagnum capillifolium, Rhytidiadelphus squarrosus* and *Hypnum* spp.

In particular, the M6c and M6d sub-communities are of very limited grazing value and of little economic importance.

5.2.5 M17 Trichophorum germanicum – Eriophorum vaginatum blanket mire

Communities/sub-communities recorded: M17, M17a

M17 *Trichophorum germanicum – Eriophorum vaginatum* blanket mire is the characteristic blanket bog vegetation of the more oceanic parts of Britain. It is typically found on deposits that are maintained in a permanently waterlogged state by a high and generally stagnant water-table (Rodwell *et al* 1991; Elkington *et al* 2001). It usually occurs on deeper peats, i.e. greater than 2 m in depth over flat or gently sloping ground (Rodwell *et al* 1991). However, it can also occur extensively on shallower peat. This community is dominated by mixtures of monocotyledons, ericoid sub-shrubs and *Sphagnum* spp. Burning, marginal peat-cutting, and drainage have often resulted in surface drying of the peat and hence a modification of the vegetation or community shift (Rodwell *et al* 1991; Elkington *et al* 2001).

The M17 community only appears within three areas mapped within the study area, forming a small part of the local vegetation; it is present in a mosaic with other mire communities (M19, M20 and M25 mires – sections 5.2.6, 5.2.7 and 5.2.9 respectively). One of the areas was mapped to sub-community level being noted as the M17a *Drosera rotundifolia – Sphagnum* sub-community. In the sward *Trichophorum germanicum* is abundant along with *Eriophorum vaginatum* and occasional *Molinia caerulea*. Other common associates present include *Eriophorum angustifolium*, *Vaccinium myrtillus, Empetrum nigrum*, *Drosera rotundifolia, Narthecium ossifragum,* and *Potentilla erecta*. Sphagna are also abundant with *Sphagnum cuspidatum*, *S. papillosum* and *S. fallax* present.

5.2.6 M19 Calluna vulgaris – Eriophorum vaginatum blanket mire

Communities/sub-communities recorded: M19, M19a

This is the typical blanket bog vegetation of high-altitude ombrogenous peats in the wet and cold climate of the uplands of northern Britain. In particular, it occurs on high-level plateaux and broad watersheds, usually above 300 m, and is confined to deeper peats on flat or gently-sloping ground (Rodwell *et al* 1991; Elkington *et al* 2001). It is generally dominated by mixtures of *Eriophorum vaginatum* and ericoid sub-shrubs (especially *Calluna vulgaris*). *Sphagnum* spp. can be prominent over wetter ground but are not as luxuriant or rich as in M17 mire (Rodwell *et al* 1991; Elkington *et al* 2001).

The M19 community is infrequently scattered throughout the study area, generally as relatively small areas and within larger areas of other mire types. The community is often present within the forest rides and clear-fell areas where the vegetation is re-colonising. A number of these areas were identified as the M19a *Erica tetralix*

sub-community. The M19 vegetation within the study area is characterised by a tussocky sward of *Eriophorum vaginatum* co-dominant with *Calluna vulgaris.* Within these swards there is also occasional *Trichophorum germanicum*, *Deschampsia flexuosa*, *Carex echinata*, *C. nigra*, *Molinia caerulea*, *Erica tetralix*, *Vaccinium myrtillus* and *Carex binervis*. In the basal layer the mosses *Pleurozium schreberi* and *Aulacomnium palustre* appear along with *Sphagnum fallax* and *S. capillifolium*. *Cladonia spp*. (lichens) are also present.

5.2.7 M20 Eriophorum vaginatum blanket mire

Communities/sub-communities recorded: M20

M20 *Eriophorum vaginatum* blanket mire is a community characteristic of ombrogenous peats on bogs where certain treatments have greatly affected the vegetation; grazing and burning have been of greatest significance, but drainage has also played a part in the development of M20 (Rodwell *et al* 1991; Elkington *et al* 2001). It is commonest on blanket mires where these factors have contributed both to floristic impoverishment and to erosion of the peats. The peats are generally drier than in M17 and most M19 bogs, often showing surface oxidation (Rodwell *et al* 1991; Elkington *et al* 2001).

This M20 *Eriophorum vaginatum* blanket mire community in the study area appears within areas of clear-fell and some forest rides. It can be found as both pure stands of M20 and in mosaics with other mire communities (e.g. M19, M23 and M25).

In the stands of M20, *Eriophorum vaginatum* is the dominant species, although *Eriophorum angustifolium* can also appear fairly consistently in these areas. Sparse associates present include *Molinia caerulea, Calluna vulgaris*, *Deschampsia flexuosa* and *Vaccinium myrtillus* along with the herb *Potentilla erecta*. The mosses *Aulacomnium palustre*, *Polytrichum commune*, *Sphagnum papillosum*, *S. fallax* and *S. capillifolium* are also found within the community together with the occasional appearance of the *Cladonia* spp. (lichens).

5.2.8 M23 Juncus effusus/acutiflorus – Galium palustre rush-pasture

Communities/sub-communities recorded: M23, M23a, M23b

This rush-pasture is a community of gently-sloping ground in and around the margins of soligenous flushes, as a zone around topogenous mires and wet heaths, and in poorly drained, comparatively unimproved or reverted pasture. It can be found on a variety of moderately acid to neutral soils that are kept moist to wet for most of the year (Rodwell *et al* 1991; Elkington *et al* 2001). As a result, this community can be, at least partially, potentially dependent on groundwater; however, it is also commonly associated with surface water flows and surface water collection. This vegetation is characterised by the abundance of either *Juncus effusus* or *J. acutiflorus* (sometimes both), with a ground layer of mesophytic herbs common in moist or permanently wet grasslands; associates are quite diverse. Acidophilous Sphagna and *Polytrichum commune* are rare in the M23 community (Averis *et al* 2004).

M23 is extensive within the study area and large expanses of the community are often present in watercourse floodplains, as well as abundant smaller patches in mosaics with and throughout a variety of other habitats where soil moisture conditions are favourable, often in close association with M25 *Molinia caerulea – Potentilla erecta* mire. It also appears to be re-colonising areas of clear-fell. Both sub communities, M23a *Juncus acutiflorus* sub-community and M23b *Juncus effusus* sub-community are present; however, M23a is the most common (see Annex C, photograph C-4). Additionally, M23b tends to be more species-poor although some stands of M23a consisted of little more than a tall sward of *J. acutiflorus*.

In stands of M23 present the rushes overwhelmingly dominate, associate species within the swards that occur more frequently to occasionally to enrich the vegetation in certain areas include *Holcus lanatus*, *Agrostis* spp., *Ranunculus repens, Molinia caerulea, Viola palustris*, *Filipendula ulmaria*, *Deschampsia cespitosa, Ajuga reptans*, *Epilobium palustre*, *Chamerion angustifolium, Rumex obtusifolius*, *R. acetosa* and *Cirsium palustre.* Where the field layer is not overly dense there can be a carpet of mosses including *Calliergonella cuspidata*, *Brachythecium rivulare, Rhytidiadelphus squarrosus* and occasionally some *Polytrichum commune*.

5.2.9 M25 Molinia caerulea – Potentilla erecta mire

Communities/sub-communities recorded: M25, M25a, M25b

M25 mire is a community of moist, but usually well aerated, acid to neutral peats and peaty soils (Rodwell *et al* 1991). It generally occurs over gently-sloping ground, marking out seepage zones and flushed margins of topogenous mires, but also extends onto the fringes of ombrogenous mires (Rodwell *et al* 1991; Elkington *et al* 2001; Averis *et al* 2004). *Molinia caerulea* is the most abundant species found in this community. The associated flora is usually species-poor and consists largely of *Juncus* spp. and a few dicotyledons; occasionally sub-shrubs can be quite common, particularly *Calluna vulgaris* and *Erica tetralix*. Treatments such as burning, grazing and drainage are likely to be largely responsible for the development of this community over ground that would naturally host some other kind of mire or wet heath vegetation (Rodwell *et al* 1991; Elkington *et al* 2001).

Aside from conifer plantation, M25 is the most extensive and common community type within the study area, it forms the major component of most forest rides and is also extensive within the larger open areas of the study area (see Annex C, photograph C-3). The extensiveness of M25 is likely due to the effects of commercial forestry plantation of the study area, the drainage associated with plantation preparation will have helped aerate the upper horizon of the peat and this, along with the effects of shading, has allowed the proliferation of *Molinia* over peaty areas that are likely to have been blanket bog in the past.

Molinia caerulea typically dominates in all stands, although in some of the wetter areas of M25 there is often co-dominant *Myrica gale*. The vegetation was most often recorded to community level; however, the majority of stands align to the M25a *Erica tetralix* sub-community (indicated here by the presence of a range of wet heath and bog associates in the sward) and further indicates the area may have previously been blanket bog, remnants of which still exist within the study area and form mosaics and transitional zones with this community. To a lesser extent, the grassier M25b *Anthoxanthum odoratum* sub-community was also recorded.

In some areas the sward consists solely of *M. caerulea*, however where there are associates these tend to be varying abundances of *Erica tetralix, Calluna vulgaris, Eriophorum vaginatum, Holcus lanatus, Galium saxatile, Potentilla erecta, Carex nigra, C. echinata*, *Narthecium ossifragum, Juncus acutiflorus and J. effusus*. Where the leaf litter of *M. caerulea* does not completely smother the ground there can be a patchy covering of mosses which include *Polytrichum commune*, *Rhytidiadelphus squarrosus, Pleurozium schreberi*, *Kindbergia praelonga*, *Hypnum* spp., and in wetter stands some *Sphagnum palustre*, *S. fallax* and *S. capillifolium*.

5.2.10 M27 Filipendula ulmaria – Angelica sylvestris mire

Communities/sub-communities recorded: M27

This community is typically found where moist, reasonably rich, circumneutral soils occur in situations protected from grazing. It can be found in both topogenous and soligenous mires and is especially typical of silted margins of slow-moving streams and soakways, the edges of flushes and damp hollows, and also of artificial habitats such as along dykes and roadside ditches and around ponds (Rodwell *et al* 1991; Elkington *et al* 2001). The community cannot tolerate any other than very light or sporadic grazing and so stands often only persist outside enclosures, and around un-reclaimed mires and flushes (Rodwell *et al* 1991; Elkington *et al* 2001). *Filipendula ulmaria* forms

the overwhelming dominant and the only constant. Bryophytes are few in number and of low cover (Rodwell *et al* 1991; Elkington *et al* 2001).

M27 was recorded in only two locations, both stands being within the very north west of the study area, within mosaics with the rush dominated M23 *Juncus effusus/acutiflorus – Galium palustre* community. In each case the stands are characteristically dominated by *Filipendula ulmaria*.

5.2.11 M28 Iris pseudacorus – Filipendula ulmaria mire

Communities/sub-communities recorded: M28

The M28 community is confined to moist, more nutrient-rich soils mostly along the oceanic seaboard of Britain. In its typical form this is a species-rich community with abundant *Iris pseudacorus* and a number of other tall herbs which can become frequent in the sward. Rushes and grasses are frequently important; however, bryophytes are scarce (Rodwell *et al* 1991; Elkington *et al* 2001).

A single small patch of M28 like habitat was recorded in the very western end of the study area by Knockreach. The area of M28 forms part of a mosaic with the M2 *Sphagnum cuspidatum/fallax* bog pool community within a larger area of standing water. The community here is dominated by a pure stand of *Iris pseudacorus*.

5.3 Wet Heaths

5.3.1 M15 Trichophorum germanicum – Erica tetralix wet heath

Communities/sub-communities recorded: M15, M15b

This wet heath community is characteristic of moist and generally acid and oligotrophic peats and peaty mineral soils in the wetter western and northern parts of Britain. It is also associated with thinner or better drained areas of ombrogenous peat (Rodwell *et al* 1991; Elkington *et al* 2001). It is a vegetation type with few constant species and wide variation in its flora and dominant species. *Calluna vulgaris*, *Molinia caerulea*, *Trichophorum germanicum* and *Erica tetralix* are usually all of high frequency, and it is mixtures of these species that give the vegetation its general character. However sometimes one or two of them may be missing and their relative proportions can be very diverse (Rodwell *et al* 1991; Elkington *et al* 2001). Grazing and burning have important effects on the floristics and structure of this community and draining and peat-cutting have extended its coverage to formerly deeper and wetter peats in which blanket mire communities (i.e. M17-M19) were initially present (Rodwell *et al* 1991; Elkington *et al* 2001).

The M15 wet heath community appears infrequently as scattered small pockets across the study area, it does not form large extensive stands and is often found in mosaics with mires such as M25. The floristics varies from stand to stand, though most areas align to the M15b Typical sub-community. The species composition is a variable mixture of the main characteristic species; *Calluna vulgaris, Molinia caerulea*, *Trichophorum germanicum* and *Erica tetralix*. Other associates present include *Narthecium ossifragum, Vaccinium myrtillus, Myrica gale, Polygala serpyllifolia, Potentilla erecta, Galium saxatile, Deschampsia flexuosa, Juncus squarrosus and Eriophorum angustifolium.* In the basal layer there is typically some *Sphagnum capillifolium*, *S. fallax, Plagiothecium undulatum*, *Aulacomnium palustre, Pleurozium schreberi*, *Hylocomium splendens* and *Hypnum* spp.

5.4 Dry Heaths

5.4.1 H9 Calluna vulgaris – Deschampsia flexuosa heath

Communities/sub-communities recorded: H9, H9c

This heath is a characteristic sub-shrub vegetation of acid and impoverished soils at low to moderate altitudes. It is normally found on very base-poor soils, highly oligotrophic and at least moderately free-draining, often excessively so, which have been derived from a wide variety of parent materials (Rodwell *et al* 1991; Elkington *et al* 2001). *Calluna vulgaris* is typically the most abundant plant in this community, often forming a fairly low and open canopy. The only other vascular constant is *Deschampsia flexuosa*, although even in open *Calluna* it often occurs only as sparse tufts, and under dense canopies it can almost disappear. Other herbs are also few and are of low cover. Bryophytes and lichens are rarely abundant and associated species diversity is low (Rodwell *et al* 1991; Elkington *et al* 2001).

Two small patches of H9 were recorded in the study area, corresponding to areas where *Calluna* is overly dominant with some sparse *Deschampsia flexuosa* and *Erica tetralix* in the sward. As a result of the lack of species diversity, one of the areas was mapped as the H9c Species-poor sub-community. The moss *Hylocomium splendens* appears sporadically.

5.4.2 H10 Calluna vulgaris – Erica cinerea heath

Communities/sub-communities recorded: H10

H10 *Calluna vulgaris – Erica cinerea* heath is a dry heath community that occurs widely throughout the more oceanic sections of Scotland and around the east-central part of the Highlands. It is a community characteristic of acid to circumneutral and generally free-draining soils and is typically dominated by *Calluna vulgaris*. *Erica cinerea*, a constant, is frequent but generally subordinate to *C. vulgaris*. H10 is commonly found in zonations and mosaics with grasslands, other heath types and mire communities (Rodwell *et al* 1991; Elkington *et al* 2001).

H10 is uncommon within the study area and where present usually only forms small patches, most often within mosaics with grassland and mire communities. The stands contain an assemblage of *Calluna vulgaris* and *Erica cinerea*, beneath which the herbs *Potentilla erecta* and *Galium saxatile* are found. The pleurocarpous mosses *Hylocomium splendens* and *Pleurozium schreberi* dominate in patches beneath the *Calluna* canopy.

5.4.3 H12 Calluna vulgaris – Vaccinium myrtillus heath

Communities/sub-communities recorded: H12, H12a

H12 *Calluna vulgaris – Vaccinium myrtillus* heath is a typical sub-shrub community of acidic to circumneutral, free-draining mineral soils throughout the cold and wet sub-montane zone, generally between 200 m and 600 m. H12 is generally dominated by *Calluna vulgaris* although the cover of this species can be open and degenerate. *Vaccinium myrtillus* is constant, though it is usually subordinate to *Calluna*. The ground layer is generally characterised by bulky mosses (Rodwell *et al* 1991; Elkington *et al* 2001). H12 heaths are rather uniform and they cover extensive areas throughout large parts of Scotland.

The H12 *Calluna vulgaris – Vaccinium myrtillus* heath is limited within the study area to three areas, mostly found in the north west of the study area on steeper sloping ground and around rare rocky outcrops; the vegetation tends to be of the H12a Typical sub-community. When it appears in several mosaics, the M25 community also features strongly (see 5.2.9 above). *Calluna vulgaris* and *Vaccinium myrtillus* are the co-abundant ericoids within this sward. The vegetation also typically includes some *Deschampsia flexuosa, Agrostis capillaris*, *Blechnum spicant* and *Galium saxatile*, occasionally along with *Erica cinerea*. The mosses *Hylocomium splendens, Hypnum jutlandicum* and *Pleurozium schreberi* characterise the basal layer beneath the shrubs.

5.5 Calcifugous Grasslands and bracken-dominated vegetation

5.5.1 U2 Deschampsia flexuosa grassland

Communities/sub-communities recorded: U2, U2b

This grassland is characteristic of base poor soils that are free draining but not parched and are sometimes quite moist. It occurs through the upland fringes and in moderately oceanic parts of the lowlands. The community is often seen in close association with some heaths and mires and can grade into them. *Deschampsia flexuosa* grassland comprises swards in which often tussocky *D. flexuosa* is the obvious dominant with a number of sparse associates (Rodwell *et al* 1992). Many stands of U2 grassland have evidently been derived from some sort of disturbance in previous heath, mire or woodland, and the community often appears to be transitional post-disturbance vegetation (Averis *et al* 2004).

The patches of this community are mostly found in the clear-fell areas within the study area where the vegetation is recovering from the effects of the dense tree canopy cover. The majority of these areas are found within the central and southern parts of the study area.

The community within the study area is apparent by dense swards of *Deschampsia flexuosa*, and the subordinate cover of associates present include varying abundances of species such as *Agrostis* spp., *Juncus effusus*, *Anthoxanthum odoratum*, *Holcus lanatus*, *Molinia caerulea, Galium saxatile*, *Potentilla erecta*, *Rumex acetosa*, *Chamerion angustifolium*, *Pteridium aquilinum* and *Cirsium palustre.* Heathier forms of U2 are also present which contain the shrubs *Calluna vulgaris* and *Vaccinium myrtillus,* with one area in particular being mapped as the U2b *Vaccinium myrtillus* sub-community. Bryophyte coverage is generally limited to sparse areas of *Rhytidiadelphus squarrosus* and *Polytrichum commune*.

5.5.2 U4 Festuca ovina – Agrostis capillaris – Galium saxatile grassland

Communities/sub-communities recorded: U4, U4a, U4b, U4d

The U4 *Festuca ovina - Agrostis capillaris - Galium saxatile* grassland is a form of predominately upland grassland of well-drained, acidic and base-poor mineral soils throughout the wet and cool regions of north-west Britain where it dominates extensive areas of pastureland (Rodwell *et al* 1992; Cooper 1997). Throughout this geographic range the community can often be found forming a distinctive component of larger mosaics of grasslands, heaths, and mires.

U4 grassland communities are generally identified on the presence of an often close-cropped, grass-rich sward dominated by various combinations of *A. capillaris*, *F. ovina* and *Anthoxanthum odoratum*, with *G. saxatile* and *Potentilla erecta* consistent associates. A well-developed moss layer is also characteristic, but in the U4b sub-community it may be limited by the dense, relatively productive sward of grasses.

U4 appears across the entire study area, usually as small patches and rarely as extensive stands; it occupies many areas where mires and areas of wetter soils give way to shallower and drier mineral based soils. The vegetation was generally recorded to community level, although a few areas were recorded to sub-community level, the most common being the U4a Typical sub-community. In much less abundance, the more improved U4b *Holcus lanatus – Trifolium repens* and the often mossy U4d *Luzula multiflora – Rhytidiadelphus loreus* sub-communities were also recorded.

Areas of U4 contain a typical mix of *Anthoxanthum odoratum, Agrostis capillaris, Festuca ovina* and *Galium saxatile*. Frequent to occasional associates present include *Holcus lanatus*, *Deschampsia flexuosa, Dactylis glomerata, Molinia caerulea, Potentilla erecta, Rumex acetosella*, *R. acetosa*, *Juncus effusus, Ranunculus repens, Ranunculus acris*, *Trifolium repens*, *Achillea millefolium*, *Luzula multiflora*, *Stellaria graminea*, *Conopodium majus*, *Carex binervis* and *Cirsium arvense*. In the slightly wetter soils *Equisetum palustre* and *Cirsium palustre* became more prevalent. The areas of U4b tend to have a much higher abundance of *Holcus lanatus* and *Trifolium repens* in the sward, often with some *Cynosurus cristatus* and *Plantago lanceolata*.

In some areas the associate species within the sward take on a heathier character with occasional *Calluna vulgaris* and *Vaccinium myrtillus*, and very occasionally *Erica cinerea* appearing in the sward.

The bryophyte cover throughout is mainly formed of *Hypnum* spp., *Hylocomium splendens, Pleurozium schreberi*, *Pseudoscleropodium purum*, *Kindbergia praelonga* and *Rhytidiadelphus squarrosus*.

5.5.3 U20 Pteridium aquilinum – Galium saxatile community

Communities/sub-communities recorded: U20, U20a, U20c

The U20 *Pteridium aquilinum – Galium saxatile* community is vegetation dominated by *Pteridium aquilinum*, which can form extensive stands. The community is most common on lower hill slopes and on marginal ground, including abandoned fields, where it forms mosaics and transitions with heaths, grasslands and woodlands. The community covers fairly deep, well aerated but often moist, base-poor and infertile soils (Rodwell *et al* 1992; Cooper, 1997). It is largely absent from wet ground and strongly flushed slopes. *Pteridium aquilinum* is the sole dominant and is overwhelmingly abundant in some stands. This is a community of little ecological value.

The U20 community features widely across the study area and can be extensive in parts. In these stands there is always a dense cover of *P. aquilinum*, in places the density of plants and amounts of frond litter prevents other species growing. Within these areas the U20c Species-poor sub-community could be found. Where other species do appear, they often include associates similar to the U4 grassland described above in section 5.5.2 and were assigned to the U20a *Anthoxanthum odoratum* sub-community.

5.6 Mesotrophic Grasslands

5.6.1 MG1 Arrhenatherum elatius grassland

Communities/sub-communities recorded: MG1

MG1 is essentially ungrazed grassland in which coarse-leaved tussock grasses are dominant in the sward. It is found on circumneutral and free draining soils throughout the British lowlands. Key to its development is the irregularity or absence of grazing (Rodwell *et al* 1992).

The MG1 *Arrhenatherum elatius* grassland community is found within a small number of areas within the study area, along the fringes of the conifer plantation. The largest stand of MG1 is in the north western corner of the study area on an elevated area of free draining soils by Glenour where the grassland has been ungrazed and neglected for some time. Here, the sward is mainly an assemblage of tussocky and rank *Arrhenatherum elatius* and *Holcus lanatus* with quite frequent *Deschampsia cespitosa*. Other species recorded here included *Festuca rubra, Poa trivialis* and *Agrostis capillaris*.

5.6.2 MG9 Holcus lanatus – Deschampsia cespitosa grassland

Communities/sub-communities recorded: MG9, MG9a

MG9 *Holcus lanatus – Deschampsia cespitosa* grassland is characteristic of permanently moist, gleyed and periodically inundated circumneutral soils across large areas of the British lowlands. It can exist on level to moderately sloping ground in areas of pasture or meadow, but can also be found along woodland rides and fen/wetland margins. MG9 typically contains a coarse and tussocky sward dominated by *D. cespitosa* (Rodwell *et al* 1992; Cooper, 1997).

MG9 is widely found within the study area and quite often present in areas that have been mapped as mosaics of various wetland communities. The community is usually found within damper hollows, within mire, rush-pasture, along the edges of watercourses, and within damper disturbed areas along road verges and in woodland clear-fell. Several areas were recorded as the MG9a *Poa trivialis* sub-community, with *Deschampsia cespitosa* being a dominant feature.

Areas of MG9 within the study area are dominated by large tussocky *Deschampsia cespitosa,* with *Holcus lanatus* co-dominant in many areas; *Juncus effusus* is also frequent and can be locally abundant. Other associate species more occasional in the swards include *Agrostis* spp., *Filipendula ulmaria*, *Juncus acutiflorus, J. effusus, Rumex acetosa, R. obtusifolius, Trifolium repens, Ranunculus acris, R. repens, Cirsium palustre, Ajuga reptans* and the mosses *Calliergonella cuspidata*, *Kindbergia praelonga* and *Rhytidiadelphus squarrosus*.

5.6.3 MG10 Holcus lanatus – Juncus effusus rush-pasture

Communities/sub-communities recorded: MG10, MG10a

MG10 is a form of rush-pasture characteristic of areas with strongly impeded drainage over a wide range of usually acid to neutral mineral soils on level to gently sloping ground (Rodwell *et al* 1992; Cooper, 1997). This community requires consistently high soil moisture (Rodwell *et al* 1992). It occurs across most of the British lowlands, with the typical sub-community being particularly prominent towards the north and west. Although found on various soil types including brown earth and calcareous earth throughout its range, this habitat can also have close associations with various types of mire vegetation and can form significant parts of rush-dominated mire mosaics in areas of suitably moist soils.

MG10, mostly being recorded as the MG10a Typical sub-community, is widespread throughout the study area. It is found in variety of locations such as damp grasslands, wet hollows, following the edges of drainage channels and roadside verges and in mosaics with various other grassland and mire communities.

The sward is typically species-poor and very heavily dominated by a thick growth of *J. effusus.* Associates appearing in the sward throughout the study area include occasional *Holcus lanatus*, *Agrostis* spp., *Deschampsia cespitosa, Anthoxanthum odoratum, Rumex acetosa, Cirsium palustre*, *Ranunculus repens*, *Senecio jacobaea* and *Urtica dioica*. The most common mosses present are *Kindbergia praelonga* and *Rhytidiadelphus squarrosus*.

5.7 Woodland and Scrub

5.7.1 W4 Betula pubescens – Molinia caerulea woodland

Communities/sub-communities recorded: W4, W4b

W4 is a community of moist, moderately acidic, though not necessarily highly oligotrophic, peaty soils. It is characteristic of thin or drying ombrogenous peats which are isolated from the influence of base-rich or eutrophic groundwaters, but is also found on peaty gleys flushed by rather base- and nutrient-poor water (Rodwell *et al* 1991; Hall *et al* 2004). *Betula pubescens* is the most common woody species and is usually dominant. The great abundance of *Molinia caerulea* is the most distinctive feature of the field layer and other species may be limited to areas between tussocks. A number of bryophytes can be found within W4; *Sphagnum* spp. are usually present (Rodwell *et al* 1991; Hall *et al* 2004).

A number of very small stands of W4 woodland can be found scattered throughout the study area, both planted and semi-natural, the majority of which are to the south-east side of the railway line that bisects the study area. Many of these stands are located along the edge of forest tracks along the edges of the conifer plantation.

These are wet woodland areas dominated by *Salix cinerea* or *Betula* spp. with occasional *Salix aurita* and *Acer pseudoplatanus*. There has been some encroachment from the surrounding conifer plantation with some self-seeded *Picea sitchensis* and *Larix* spp. found within some of these stands.

The field layer is typically dominated by *Molinia caerulea* (and a species composition similar to that of M25 mire – see section 5.2.9), although this was found to be sparse at times due to the extent of the bryophyte cover in certain areas. Some stands contained frequent *Juncus effusus* and occasional *Deschampsia cespitosa* which is typical of the W4b *Juncus effusus* sub-community. Much of the field layer throughout the community was species-poor.

The moss cover beneath the woodland canopy does at times dominate with mixtures of *Pleurozium schreberi*, *Hylocomium splendens* and *Rhytidiadelphus squarrosus* in particular. Within the wetter areas, *Sphagnum* moss is sometimes abundant with *Sphagnum fallax*, *S. palustre*, *S. cuspidatum* and *S. capillifolium* as well as *Polytrichum commune*.

5.7.1 W7 Alnus glutinosa – Fraxinus excelsior – Lysimachia nemoreum woodland

Communities/sub-communities recorded: W7

W7 is typical of moist to very wet mineral soils which are only moderately base-rich and not very eutrophic (Rodwell *et al* 1991; Hall *et al* 2004). It is most extensive in the wetter parts of Britain, but usually occurs in soils where there is no great tendency for peat accumulation. *Alnus glutinosa* tends to be the main tree species and is commonly accompanied by other species such as *Fraxinus excelsior*, *Betula* spp., *Salix* spp. and *Acer pseudoplatanus*. The field layer can be very varied; the wetness and nutrient status of the soil determines what other species may occur, these being mainly grasses and herbaceous dicotyledons (Rodwell *et al* 1991; Hall *et al* 2004). There are three sub-communities; differences between them are related to the extent of waterlogging, the nature of the water supply and its movement.

Three patches of W7 are located within the study area to the very north west. All were recorded to community level only due to the size of the stands and lack of sub-community indicator species. Several stands were recorded as semi-natural and one was identified as more scrub like than woodland, being characterised by short scrubby *Salix* spp. over a wet neutral field flora. The areas of W7 generally consist of canopies of *Salix* spp. although *Alnus glutinosa* did feature as dominant in one stand. The field layer in these areas of W7 is dominated by *Juncus* spp. or in some cases *Deschampsia cespitosa*, with an associated species assemblage similar to those as described for the M23, MG9 or MG10 communities above.

5.7.2 W11 Quercus petraea – Betula pubescens – Oxalis acetosella woodland

Communities/sub-communities recorded: W11

W11 is a community of moist, free-draining base-poor brown earth soils in the cooler, wetter north-west of Britain. It is characteristic of substrates that are neither markedly calcareous nor strongly acidic. The character of the community is often heavily influenced by grazing (Rodwell *et al* 1991; Hall *et al* 2004). These woodlands have a canopy of *Betula* spp. and/or *Quercus* spp. and a field layer dominated mainly by grasses. The canopy composition reflects its affinities with the W17 *Quercus petraea – Betula pubescens – Dicranum majus* community, and from which it is distinguished mainly by the swards of grasses including *Agrostis* spp., *Holcus mollis* and *Anthoxanthum odoratum*, rather than one dominated by pleurocarpous mosses, sub-shrubs and *Deschampsia flexuosa*.

Within the study area, a small number of semi-natural woodland stands were found to most closely fit the W11 community despite a relatively uncharacteristic canopy. Several stands form mosaics with grassland and other woodland communities. All other areas form pure stands of W11 within the central and north west study area.

The areas of non-typical canopy W11 within the study area varies with a mix of abundant *Acer pseudoplatanus*, *Betula* spp., *Salix cinerea, S. caprea*, with occasional *Picea sitchensis* and *Ulmus glabra*. The grassy understorey is a mixed assemblage of *Anthoxanthum odoratum*, *Deschampsia flexuosa, Festuca rubra*, *Holcus lanatus*, *Holcus mollis*, *Poa* spp., *Agrostis* spp., and *Pteridium aquilinum*. The grassy understorey included a number the herbs such as *Ranunculus* spp., *Galium saxatile*, *Rumex acetosa*, *Potentilla erecta, Oxalis acetosella*, *Conopodium majus* and *Cirsium palustre*. Occasionally *Urtica dioica* and *Dryopteris* spp. also appeared within these stands. Bryophyte cover consisted of frequent *Rhytidiadelphus squarrosus* and *Hylocomium splendens*.

The largest stand of semi-natural W11 is more typical and present in the very north west of the study area at Shalloch Wood, on steep slopes abutting the Water of Tig. The woodland here is dense *Betula* spp. with occasional *Sorbus aucuparia* and more rarely some *Salix* spp. and *Alnus glutinosa*. The ground storey is manly dominated by *Pteridium aquilinum*.

5.7.1 W21 Crataegus monogyna – Hedera helix scrub

Communities/sub-communities recorded: W21

W21 *Crataegus monogyna – Hedera helix* scrub is the typical sub-climax woody community of circumneutral to base-rich soils throughout the British lowlands. It usually develops by the invasion of neglected bare ground or untreated herbaceous vegetation or where woodland has been degraded (Rodwell *et al* 1991). Hedgerow stands are often of planted origin. It is a variable community which includes most of the seral thorn scrub and many hedges in the British Isles. The vegetation is always dominated by various mixtures of smaller trees and shrubs, undershrubs and woody climbers (Rodwell *et al* 1991). *Crataegus monogyna* is the most common plant overall, and can be a sole dominant in some stands (Rodwell *et al* 1991).

A single patch of W21 was recorded within the north west of the study area. It forms a mosaic with the W7 and W11 woodland communities (see above). The community appears as small scrubby patches dominated by *Crataegus monogyna* bushes.

5.7.2 W23 Ulex europaeus – Rubus fruticosus scrub

Communities/sub-communities recorded: W23

The W23 community is dominated by *Ulex europaeus* and has a usually sparse and species-poor ground flora which may be totally absent. It is a community of acidic and free draining soils on gentle to steep, rocky slopes at low altitudes. The vegetation often develops after woodland clearance of, or on, abandoned pasture (Rodwell *et al* 1991; Averis *et al* 2004).

A few small areas of W23 *Ulex europaeus – Rubus fruticosus* scrub features within the north west of the study area. This includes pure stands of *Ulex europaeus*. Due to the extent of the dense bushy *U. europaeus* scrub the understorey is species-poor with a lack of associate species.

5.8 Swamps and Tall-Herb Fens

5.8.1 S12 Typha latifolia swamp

Communities/sub-communities recorded: S12, S12a

S12 is most characteristic of standing or slow-moving, mesotrophic to eutrophic, circumneutral to basic waters with silty substrates. It is frequent around lowland lakes ponds and reservoirs and along canals and sluggish streams. *Typha latifolia* is always dominant in this type of swamp, forming an open or closed cover of shoots usually 1-2 m tall.

Four small areas of the S12 *Typha latifolia* swamp were recorded within the study area, all found within mosaics, most commonly with *Juncus* spp. dominated communities. A single area was recorded as the S12a *Typha latifolia* sub-community. The community contains a dense stand of *Typha latifolia* within a waterlogged area of the verge within a wider area dominated by wet heath. No other vascular species were present.

5.8.2 S28 Phalaris arundinacea tall-herb fen

Communities/sub-communities recorded: S28

S28 comprises vegetation in which *Phalaris arundinacea* is dominant, forming an often-dense canopy, usually 1-1.5 m tall. The vegetation is almost always species-poor and no associates tend to be frequent throughout (Rodwell *et al* 1995). The community is typical of the margins of fluctuating, circumneutral and mesotrophic to eutrophic waters, both standing and running (Rodwell *et al* 1995). Although it can be found on organic soils, it is more characteristic of mineral substrates, from fine clays to coarse gravels. It is common in open-water transitions around ponds and lakes of all sizes and also occurs around reservoirs and in some floodplain and basin mires. It can also be widespread along periodically flooded ditches and by rivers (even fast flowing hill streams) and patchily over river shoals (Rodwell *et al* 1995).

Three small patches of S28 *Phalaris arundinacea* dominated vegetation were recorded, one pure stand to along the north western study area boundary, and other stands being found within mosaics with other wet grassland and mire communities.

5.9 Vegetation of Open Habitats

5.9.1 OV27 Chamerion angustifolium community

Communities/sub-communities recorded: OV27

OV27 *Chamerion angustifolium* tall-herb vegetation is a community that occurs on damp, fertile, disturbed soils in woodlands, on heaths and along road verges and railway embankments (Rodwell *et al* 2000). It is also commonplace in regenerating conifer plantation clear-fell areas. The OV27 community is marked by the dominant tall growth of *C. angustifolium*.

Patches of OV27 feature within the mosaic of communities found within the clear-fell areas. It is also widespread within the areas that have re-colonised after tree felling. The mosaics are usually made up with a mix of mire and acid grassland.

The tall herb *Chamerion angustifolium* dominates the areas within which it grows with no distinctive associates present due to its tall growth, suppressing the underlying vegetation. Such stands are therefore mapped at the community level.

5.10 Non-NVC Communities & Categories

5.10.1 Overview

A number of non-NVC vegetation types or features were mapped during the survey. These were classified as follows. Codes used in the results Figures are given in parentheses:

- Conifer plantation (CP);
- Young conifer plantation (YCP);

- Scattered trees (ST);
- Broadleaved plantation (BP);
- Clear-fell (CF);
- Bare ground, soil, hardstandings (BG);
- Buildings (BD);
- *Juncus effusus* acid grassland community (Je);
- *Juncus acutiflorus* acid grassland community (Ja);
- Standing water (SW);
- Area not surveyed (NSA);
- Recently disturbed ground (DG); and
- Naturally regenerating conifers (RG).

The plantation areas (CP, YCP, BP) were unremarkable in terms of their flora and species composition. In more mature plantations there is often no ground flora except some scattered mosses due to the density of trees and the canopy and shading effects of maturing trees, the ground instead being blanketed in woody debris and conifer needles. Conifer plantation makes up the vast majority of the study area, mainly *Picea sitchensis* plantation. Throughout the study area the open habitats sometimes contain a few scattered or isolated trees (ST), but not in enough abundance or extent to constitute woodland, these are usually small invading conifers from nearby plantation or scattered scrubby *Salix* spp. In other instances, some small areas of formerly felled plantation contained abundant small naturally self-seeded and regenerating *Picea sitchensis* (RG); e.g. within keyhole areas for Arecleoch Windfarm turbines in the west of the study area.

Areas of bare ground (BG) were lacking vegetation within the study area. An area of disturbed ground (DG) was recorded as being recolonised with a pure stand of *Juncus effusus* and is denoted as 'DG>Je'. These areas, along with buildings (BD) and standing water (SW) were lacking vegetation, were non-natural, or floristically poor and of negligible botanical importance; these are therefore not discussed further within this report.

Some small areas within the study area could not be surveyed (NSA) due to being inaccessible, such as the railway track embankments.

Further descriptions and details of all other bulleted vegetation or feature types listed above are provided below.

5.10.2 Clear-felled plantation (CF)

There are many areas of recently clear-felled (CF) plantation within the study area, and active harvesting was ongoing during the survey periods. Consequently, the proportions of standing planation and clear-fell are in constant flux; habitat mapping undertaken indicates respective extents at the time of survey. Many areas of clear-fell, due to the short time since felling contain little other than stumps, brash, churned up ground and sometimes isolated patches of mosses such as *Plagiothecium undulatum*.

However, some areas that have been clear-felled for longer and not yet re-planted are now re-vegetating with secondary semi-natural vegetation through the remnant stumps and brash. The majority of re-vegetating clear-fell areas are denoted by the '>' symbol within Figure 8.3. This also indicates the closest-fit NVC community to which the clear-felled area now appears to be developing towards, e.g. 'CF > M19' indicates that mire vegetation resembling the M19 community is recolonising the clear-fell area. Throughout the NVC study area sections of clear-fell appear in transition to a number of different communities, the most common being M6, M19, M20, M23, M25, MG9, MG10, OV27, U2, U4, U20, Ja, Je and RG. In a few areas young trees are invading and in time fragments of W4 and W11 communities would likely develop.

5.10.3 Juncus effusus (Je) and Juncus acutiflorus (Ja) acid grassland communities

The 'Je' and 'Ja' acid grassland communities are present here as patches of a *Juncus* spp. dominated calcifuge grassland. This is vegetation in which very dominant and tall tussocks of *J. effusus* or swards of *J. acutiflorus* grow abundantly among a few shorter 'acid grassland' swards including frequent to occasional *Agrostis capillaris, Holcus lanatus, Rumex acetosa, Potentilla erecta* and *Galium saxatile*. Other occasional species include *Carex nigra*, *Deschampsia cespitosa, Molinia caerulea* and *Ranunculus repens*. Mosses typical of acid communities are also very abundant, and in some cases can be the only species present along with a uniform sward of *Juncus* spp., the most common mosses are *Hylocomium splendens*, *Pleurozium schreberi*, *Polytrichum commune, Pseudoscleropodium purum, Rhytidiadelphus squarrosus* and *R. loreus.*

This vegetation does not fit into any NVC community as it lacks the wetland element and key indicators of M6 and M23 *Juncus* spp. mires and has a more acidophilous flora than MG10 *Juncus effusus* rush-pasture; it is therefore classed separately.

Both the Je and Ja communities are found within the study area, however Je is by far the more prevalent of the two. These communities were found to be more common within the central and south eastern half of the study area.

This vegetation is of limited botanical interest, but in light of the SEPA classification of potential GWDTEs these non NVC types Je and Ja should also qualify for potential GWDTE status. The classification of moderate sensitivity is in line with other similar *Juncus* spp. dominated grassland communities (e.g. MG10).

5.11 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.

5.12 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.

5.13 Correspondence with Phase 1 Habitats

For each of the above-described vegetation and habitats types found in this survey, Table 6-1 shows the equivalent habitats according to the Phase 1 habitat classification (JNCC, 2010) for this study area, taking into account the species composition and habitat quality. For instance, typical blanket bog communities such as M17, M19 and M20 have been classed as wet modified bog due to the evident impacts from forestry, drainage and grazing upon the mire present.

Furthermore, many NVC communities can fall within different Phase 1 types; for example, within the study area stands of woodland such as W4 can often be either semi-natural or plantation, these therefore have been assigned the different respective Phase 1 codes. In a further example, communities such as M4 and M6 can be considered either flushes or types of fen, e.g. basin mire, depending on the local setting.

The Phase 1 results are shown on Figure 8.2 and have been interpreted from field surveys, mapping data, and the NVC polygon data broadly using Table 6-1. Polygons where there are mosaic NVC communities have

generally been assigned a single Phase 1 classification based on the dominant NVC type (despite many polygons containing multiple Phase 1 types, often in low percentages). Therefore, Figure 8.2 is a broad overview, and the NVC data (Figure 8.3) should be consulted for further detail in a specific area.

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

Phase 1 Equivalents	NVC & Other Habitats/Features Recorded
A1.1.1 Woodland: broadleaved, semi-natural	W4, W7, W11
A1.1.2 Woodland: broadleaved, plantation	W4, BP
A1.2.2 Woodland: coniferous, plantation	CP, YCP
A2.1/A2.2 Scrub: dense-continuous/scattered	W7, W21, W23
A3.1 Broadleaved scattered trees	ST
A4.2 Recently-felled woodland: coniferous	CF
B1.1/B1.2 Acid grassland: unimproved/semi-improved	U2, U4
B2.1/B2.2 Neutral grassland: unimproved/semi-improved	MG1, MG9
B5 Marsh/marshy grassland	M23, M25b, M27, M28, MG10, Ja, Je, DG>Je
C1.1/C1.2 Bracken: continuous/scattered	U20
C3.1 Other tall herb & fern: tall-ruderal	OV27
D1.1 Dry dwarf shrub heath - acid	H9, H10, H12
D2 Wet dwarf shrub heath	M15
E1.7 Bog: wet modified	M17, M19, M20, M25a
E2.1 Flush/spring: acid/neutral	M4, M6
F1 Swamp	S12, S28
G1 Open water – standing water	M2, M3, SW
J3.6 Buildings	BD
J4 Bare ground	BG
J5 Other habitat	CF>RG

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 GWDTE;
- 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, 2017). 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 10: Hydrology, Hydrogeology, Geology and Soils).

Using SEPA's (2017) 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
M27	*Filipendula ulmaria – Angelica sylvestris* mire
M28	*Iris pseudacorus – Filipendula ulmaria* mire
MG9	*Holcus lanatus – Deschampsia cespitosa* grassland
MG10	*Holcus lanatus – Juncus effusus* rush pasture
Je & Ja[3]	*Juncus effusus* & *Juncus acutiflorus* acid grassland
W4	*Betula pubescens – Molinia caerulea* woodland
W7	*Alnus glutinosa – Fraxinus excelsior – Lysimachia nemoreum* 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 8.4.

Within Figure 8.4 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;

[3] In light of the SEPA classification on potential GWDTEs the non-NVC types 'Je' and 'Ja' should also qualify for potential GWDTE status. The classification of moderate sensitivity is keeping in line with other similar *Juncus* spp. dominated grassland communities (e.g. MG10).

- '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; and
- '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, 2017). 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 10: Hydrology, Hydrogeology, Geology and Soils).

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, substrates and so on.

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.

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

Table 6-2 NVC Communities Recorded and Corresponding Annex I Habitat Types

NVC Code	NVC Community Name	Annex I Code	Annex I Title
M3	*Eriophorum angustifolium* bog pool community	7130	Blanket bog
M4	*Carex rostrata - Sphagnum fallax* mire community	7140	Transition mires and quaking bogs
M15, M15b	*Trichophorum germanicum – Erica tetralix* wet heath	4010	Northern Atlantic wet heaths with *Erica tetralix*
M17	*Trichophorum germanicum – Eriophorum vaginatum* blanket mire	7130	Blanket bog
M19	*Calluna vulgaris – Eriophorum vaginatum* blanket mire	7130	Blanket bog
M20	*Eriophorum vaginatum* blanket mire	7130	Blanket bog
M25, M25a	*Molinia caerulea – Potentilla erecta* mire	7130	Blanket bog, where peat depth is greater than 0.5 m
H9, H9c	*Calluna vulgaris – Deschampsia flexuosa heath*	4030	European dry heaths
H10	*Calluna vulgaris - Erica cinerea* heath	4030	European dry heaths
H12, H12a	*Calluna vulgaris – Vaccinium myrtillus* heath	4030	European dry heaths

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, M19 and M20. As such, M3 within the study area is assigned to the blanket bog Annex I type. M2 is not assigned to the blanket bog Annex I type, as it is not associated with areas of M17, M19 and M20 mire.

M25 mire can also fall within the 7130 blanket bog Annex I type where the underlying peat depth is greater than 0.5 m. As described in section 5.2.9 above, M25 within the study area for the most part is associated in some way with wet heath and blanket bog. These areas have also been classified as potential Annex I blanket bog, to represent a worst-case scenario.

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 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*.

[4] http://jncc.defra.gov.uk/page-1523

The dry heath communities recorded – 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 Annex I Woodlands

None of the woodlands within the study area were considered to fall within any possible respective Annex I types such as Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*, Old sessile oak woods with *Ilex* and *Blechnum*, Caledonian forest, or Bog woodland due to the respective woodland stands often being patches of plantation, young scrub invasion, not containing the appropriate canopy species or associated species assemblage, or being outwith the required geographical range or landscape setting.

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.

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 a large number of NVC types.

The relevant SBL priority habitat types (full descriptions of which can be found on the SNH website[5]), and associated NVC types recorded within the study area are as follows:

- **Wet woodland:** W4b, W7;
- **Blanket bog:** M17, M19, M20, M3 (where associated with M17, M19 and M20), and M25 (where peat depth is greater than 0.5 m);
- **Upland flushes, fens and swamps:** M4, M6, M23a, M27, M28; and
- **Upland heathland:** M15, H9, H10 and H12.

These SBL priority habitats correspond with UK Biodiversity Action Plan (BAP) Priority Habitats[6].

6.5 Summary

Table 7-3 provides a summary of all the NVC communities recorded within the study area, and any associated habitat sensitivities as described in the sections above.

Table 6-3 Summary of study area NVC communities and sensitivities

NVC Codes Recorded	Potential GWDTE Status	Annex I Type Code	SBL Priority Habitat Type
Woodland and Scrub			
W4, W4b	High	-	Wet woodland
W7	High	-	Wet woodland
W11	-	-	-
W21	-	-	-
W23	-	-	-
Mires and Wet Heath-			
M2a	-	-	-
M3	-	7130 Blanket bogs	Blanket bog
M4	-	7140 Transition mires and quaking bogs	Upland flushes, fens and swamps
M6, M6c, M6d	High	-	Upland flushes, fens and swamps
M15, M15b	Moderate	4010 Northern Atlantic wet heaths with *Erica tetralix*	Upland heathland
M17, M17a	-	7130 Blanket bogs	Blanket bog
M19, M19a	-	7130 Blanket bogs	Blanket bog
M20	-	7130 Blanket bogs	Blanket bog
M23, M23a, M23b	High	-	Upland flushes, fens and swamps (applies to **M23a** only)
M25, M25a, M25b	Moderate	7130 Blanket bogs (where peat is greater than 0.5 m deep)	Blanket bog (where peat is greater than 0.5 m deep)
M27	Moderate	-	Upland flushes, fens and swamps
M28	Moderate	-	Upland flushes, fens and swamps
Dry Heaths			
H9, H9c	-	4030 European dry heaths	Upland heathland
H10	-	4030 European dry heaths	Upland heathland
H12, H12a	-	4030 European dry heaths	Upland heathland
Calcifugous Grasslands			
U2, U2b	-	-	-
U4, U4a, U4b, U4d	-	-	-
U20, U20a, U20c	-	-	-
Mesotrophic Grasslands			
MG1	-	-	-
MG9, MG9a	Moderate	-	-
MG10, MG10a	Moderate	-	-
Swamps and Tall-Herb Fens			
S12, S12a	-	-	-
S28	-	-	-
Vegetation of Open Habitats			
OV27	-	-	-

[5] https://www.nature.scot/scotlands-biodiversity/habitat-definitions
[6] http://jncc.defra.gov.uk/page-5718

7 SUMMARY

The surveys revealed the presence of a relatively restricted range of habitat types, culminating in 29 NVC community types being recorded within the study area, along with a range of further sub-communities. A number of non-NVC types were also recorded. Aside from the vast expanses of coniferous plantation, only a small number of community types account for the majority of the study area.

The most common and widespread semi-natural communities which make up the main bulk of the landscape are M25 *Molinia caerulea – Potentilla erecta* mire, M23 *Juncus effusus/acutiflorus – Galium palustre* rush-pasture and M6 *Carex echinata – Sphagnum fallax/denticulatum* mire. The remainder of the study area is made up of a relatively small number of mainly mire, grassland, woodland and heath communities.

It is clear from the vegetation communities described for the study area and discussed in the various sections above that the habitats have been heavily influenced by anthropogenic interaction, with the single largest factor being the widespread commercial conifer plantation and its associated drainage, drying and shading effects. It is likely over recent history this may have caused shifts in the communities present, for instance it is likely that better quality mire was once much more extensive across the study area but the effects of forestry have allowed expansion of M25 *Molinia caerulea – Potentilla erecta* mire. Although some large relatively homogenous stands of vegetation occur, most of the communities described above often form complex mosaics and transitional areas across the study area and are maintained by the current management regime.

8. GLOSSARY

acidophilous: plants/bryophytes that prefer to grow in an acidic environment.

base-poor: environments which have few chemical bases, they are dominated by environmental acids (usually organic acids) and so are acidic.

base-rich: environments which are neutral or alkaline.

base-richness: the level in soil or water of chemical bases, such as calcium or magnesium ions. Chemical bases are alkalis. Many plants and bryophytes are restricted to base-rich or base-poor environments.

basiphilous: plants/bryophytes that prefer to grow in a basic environment.

calcareous: calcareous grassland forms on soils that are base-rich.

calcicolous: a plant that grows and thrives in soil rich in lime.

calcifugous: growing or living in acid soil.

circumneutral soil: nearly neutral, having a pH between 6.5 and 7.5.

dicotyledon: a plant that produces flowers and has two cotyledons (i.e. embryonic leaves).

forb: a herbaceous flowering plant that is not a graminoid (grasses, sedges and rushes).

graminoid: grasses; monocotyledonous, usually herbaceous plants with narrow leaves growing from the base. They include the true grasses, of the family Poaceae (also called Gramineae), as well as the sedges (Cyperaceae) and the rushes (Juncaceae).

mesophytic: a land plant that grows in an environment having a moderate amount of moisture, neither a particularly dry nor particularly wet environment.

mesotrophic grassland: neutral grassland, characterised by vegetation dominated by grasses and herbs on a range of circumneutral soils.

lagg: zone where water draining a bog meets that from adjoining mineral soils. A characteristic of the lagg zone is that normally it has more available plant nutrients, is more alkaline and hence shows greater species diversity.

monocotyledons: flowering plants group which have just one cotyledon.

mor: forest humus that forms a layer of largely organic matter distinct from the mineral soil beneath.

mosaic: a pattern of two or more vegetation types disposed in intimate relationships to one another.

oligotrophic: lacking in plant nutrients.

ombrogenous: dependant on rain for its formation. Ombrogenous bog is a peat-forming vegetation community lying above groundwater level: it is separated from the mineral soil, and is thus dependent on rain water for mineral nutrients. The resulting lack of dissolved bases gives strongly acidic conditions. Two types of ombrogenous bogs are commonly distinguished: raised bogs and blanket bogs.

pleurocarpous: A type of moss in which the female sex organs and capsules are borne on short, lateral branches, and not at the tips of branches. Pleurocarpous mosses tend to form spreading carpets rather than erect tufts.

podsol: a soil that develops in temperate to cold moist climates under coniferous or heath vegetation; an organic mat over a grey leached layer.

siliceous: containing abundant silica; (plants) growing in or needing soil rich in silica.

soligenous: where water movements are predominantly lateral. Produced by inflow of surface water or rise of groundwater and not completely by locally precipitated water.

topogenous mire: a type of mire that forms under climatic conditions of reduced rainfall, with consequent lower humidity and summer drought, which restrict the growth of wetland vegetation to areas where precipitation is concentrated (e.g. valley bottoms).

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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 8.3 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	21370	82221	M6c	Small M6c runnel in infilled forest drain.	
2	21328	82168	M6c	Small M6c runnel in infilled forest drain.	
3	22081	78810	M6c	Flush with *Juncus effusus*, *Potentilla erecta*, *Galium saxatile*, *Sphagnum fallax* and *Polytrichum commune*.	B-1
4	22038	79590	M3	Bog pool with *Eriophorum angustifolium*, *Narthecium ossifragum*, *Erica tetralix*, *Sphagnum fallax*, *Sphagnum cuspidatum*, *Sphagnum capillifolium* and *Sphagnum magellanicum*.	B-2
5	22040	79612	M3	Bog pool with same species as TN4 above.	
6	29134	79301	M3	Bog pool with *Eriophorum angustifolium*, *Drosera rotundifolia*, *Narthecium ossifragum*, *Sphagnum papillosum* and *S. cuspidatum*.	
7	21967	79340	M3	Bog pool with same species as TN4 above.	
8	22206	79602		Small pool surrounded by rock debris. Likely to have been created from construction of track. Contains *Carex viridula* and some *Juncus* spp.	
9	19637	81270		Pool – contains *Menyanthes trifoliata*, *Juncus acutiflorus* and *J. effusus*.	
10	20544	81707	M6c	Flush with *Carex* spp., *J. effusus*, *Polytrichum commune* and *Sphagnum fallax*.	
11	20701	82031	M6	Flush.	
12	20688	82595	M6c	Flush with *J. effusus*, occasional *Molinia caerulea* and *Sphagnum fallax*.	
13	18776	80688	M3	*Eriophorum angustifolium*, *E. vaginatum* and *Sphagnum fallax*.	
14	19224	79859	M6	Flush running along edge of forest ride.	

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; instead a number of photographs are provided in order to give a general characterisation of certain types of community present, and to also show local variation between communities of the same NVC class.

Photo B. 1 Target note 3 – M6c flush

Photograph B-1: Target note 4 – M3 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.

Photograph C-1: M4 and M6 mire mosaic within forestry ride

Photograph C-2: M6d flanking watercourse

Photograph C-3: M6c (*Juncus effusus*) weaving through a forest ride consisting of M25 mire – very typical of the study area

Photograph C-4: M23a *Juncus acutiflorus* rush-pasture in hollow

Photograph C-5: M23a and MG10a rush-pastures mosaic

Photograph C-6: Large rush dominated floodplain containing M6, M23, MG10 and MG9

Photograph C-7: M25 mire with abundant Myrica gale

Photograph C-8: U2 (pale sward to left) and U4 (green sward right) grasslands