

Appendix 12.3

Phase 2 Habitat Survey (NVC)

Contents

1	Introduction	1
2	The Study Area	2
3	Methodology	3
4	Survey Constraints and Limitations	4
5	NVC Survey Results and Vegetation Descriptions	5
5.1	Summary of NVC Communities	5
5.2	Mires and Flushes	5
5.3	Wet Heaths	14
5.4	Dry Heaths	16
5.5	Springs	20
5.6	Calcifugous Grasslands and bracken-dominated vegetation	21
5.7	Mesotrophic Grasslands	25
5.8	Woodlands and Scrub	27
5.9	Swamps and Tall-Herb Fens	30
5.10	Vegetation of Open Habitats	31
5.11	Non-NVC Communities & Categories	31
6	Evaluation of Botanical Interest	33
6.1	Overview	33
6.2	Groundwater Dependent Terrestrial Ecosystems (GWDTE)	33
6.3	Annex I Habitats	34
6.4	Scottish Biodiversity List Priority Habitats	38
6.5	Cairngorms National Park Authority Priority Habitats	39
6.6	Summary	40
7	Future Survey Requirements	42
7.2	GWDTE	42
7.3	Peat Depth	42
8	Summary	43
9	Glossary	44
10	References	46
11	NVC Target Notes	48
12	Target Note Photographs	53

Tables

Table 2.1.1: Designated sites with botanical qualifying features that overlap with the Project 8 study area	2
Table 6.1.1: NVC communities within the study area which, depending on hydrogeological setting, may potentially be classified as GWDTE (yellow = moderately groundwater dependent and red = highly groundwater dependent)	33
Table 6.2.1: NVC communities within the study area and corresponding Annex I habitat types	35
Table 11.1.1: Project 8 study area target notes	48

Photographs

Photograph B-1: Target note S1_1.	53
Photograph B-2: Target note S1_4.	54
Photograph B-3: Target note S1_4.	54
Photograph B-4: Target note S1_6.	55
Photograph B-5: Target note S1_7.	55
Photograph B-6: Target note S1_12.	56
Photograph B-7: Target note S1_14.	56
Photograph B-8: Target note S1_17.	57
Photograph B-9: Target note S3_2.	57
Photograph B-10: Target note S3_2.	58
Photograph B-11: Target note S3_7.	58
Photograph B-12: Target note S3_8.	59
Photograph B-13: Target note S3_10.	59
Photograph B-14: Target note S3_11	60
Photograph B-15: Target note S3_12.	60
Photograph B-16: Target note S3_14.	61
Photograph B-17: Target note S4_3.	61
Photograph B-18: Target note S4_5.	62
Photograph B-19: Target note S4_7.	62
Photograph B-20: Target note T1_7.	63
Photograph B-21: Target note T1_8.	63



A9 Dualling – Glen Garry to Dalraddy
Project 8
National Vegetation Classification Survey Report

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1 Introduction

- 1.1.1 CH2M Hill Fairhurst Joint Venture (CFJV) is the Lead Design Consultant for the A9 Dualling Central Section (Glen Garry to Dalraddy). MacArthur Green has been commissioned to assist CFJV with vegetation and habitat classification elements relating to the Design Manual for Roads and Bridges DMRB Stage 2 options appraisal and DMRB Stage 3 iterative design assessment process.
- 1.1.2 Surveys took the form of National Vegetation Classification (NVC) surveys. The NVC scheme provides a standardised system for classifying and mapping semi-natural habitats in Great Britain. The aim of the NVC survey was to classify, map and describe the vegetation communities present within the relevant study area in order to identify those areas of greatest ecological interest/sensitivity: Habitats Directive Annex I habitats, Scottish Biodiversity List (SBL) priority habitats, Cairngorms National Park Authority (CNPA) priority habitats and potential Groundwater Dependent Terrestrial Ecosystems (GWDTE).
- 1.1.3 This document details the results of the NVC field surveys (together with an evaluation of those communities recorded) carried out for Project 8 (Dalwhinnie to Crubenmore) during 2015, as part of the DMRB Stage 3 assessment. Project 8 is divided into Sections 1-4, with smaller tie-in areas at the southern and northern ends.

2 The Study Area

- 2.1.1 Project 8 extends from a short distance south of Dalwhinnie northwards to Crubenmore. The study area within which NVC surveys were undertaken was determined by buffering the maximum extent of the design footprint by 250 metres (m). The 250 m buffer was applied to ensure surveys covered the necessary area to determine the presence of potential GWDTEs, in line with Scottish Environmental Protection Agency (SEPA) guidance on GWDTE (SEPA, 2014a, 2014b). However, in certain areas it was possible to reduce the extent of the 250 m buffer and associated study area due to the presence of a natural hydrological barrier, which would mean any potential GWDTE on the other side of the hydrological barrier would not be affected by any dualling works on the A9. Two such hydrological barriers were identified within Project 8: the River Truim to the west of the A9 and part of the Loch Cuaich-Dalwhinnie aqueduct to the east of the A9. The aqueduct, which is a relatively deep-set concrete structure, is likely to restrict or locally inhibit shallow groundwater flows downslope; it is also likely to act as a barrier to potential impacts on GWDTE upslope of the aqueduct. No other hydrological barriers were identified: the existing A9 and adjacent railway were not considered hydrological barriers because of the potential for deeper groundwater flows to exist beneath them.
- 2.1.2 The Project 8 study area contains a wide range of predominately open upland habitats, but also some vegetation and habitat types more typical of lowland areas. The study area to the west of the current A9 is generally lower lying and flatter terrain than to the east, and supports a mixture of mire, upland grassland and lowland grassland types in the floodplain of the River Truim. The study area to the east of the existing A9 contains a wide range of upland grasslands, mires, and heaths. Most of the vegetation in the study area has been impacted anthropogenically over time in a number of ways, mainly through moorland management techniques such as muirburn (for grouse), grazing and drainage, but also forestry in some areas: these management activities have clearly influenced the plant communities here.
- 2.1.3 Parts of the study area also overlap with designated sites containing habitat related, or botanical, qualifying features. Along Project 8 the study area covered parts of the Drumochter Hills SSSI and Drumochter Hills SAC. The relevant qualifying features for each designation are detailed in **Table 2.1.1** below.

Table 2.1.1: Designated sites with botanical qualifying features that overlap with the Project 8 study area

Designated Site	Qualifying Feature	Last Assessed Condition	Last Site Condition Monitoring Assessment Date
Drumochter Hills SSSI	Montane assemblage	Favourable Maintained	31/07/2006
	Vascular plant assemblage	Unfavourable Declining	15/08/2003
Drumochter Hills SAC	Alpine and subalpine heaths	Unfavourable No change	05/07/2006
	Blanket bog	Unfavourable No change	06/07/2006
	Dry heaths	Unfavourable No change	06/07/2006
	Montane acid grasslands	Unfavourable No change	06/07/2006
	Mountain willow scrub	Unfavourable No change	06/07/2006
	Plants in crevices on acid rocks	Unfavourable No change	06/07/2006
	Species-rich grassland with mat-grass in upland areas	Unfavourable No change	06/07/2006
	Tall herb communities	Unfavourable Recovering	31/07/2006
	Wet heathland with cross-leaved heath	Unfavourable No change	06/07/2006

3 Methodology

- 3.1.1 The vegetation was surveyed by a team of 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.
- 3.1.2 Homogenous stands and mosaics of vegetation were identified and mapped by eye, and drawn as polygons on high resolution field maps; i.e. 1:5,000 @A3 using 10 cm orthoimagery. 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. 10 cm resolution aerial photography of the study area was used to aid accurate mapping of vegetation boundaries. 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.
- 3.1.3 Quadrat sampling was not used in this survey because experienced NVC surveyors do not need to record quadrats in order to identify NVC communities and sub-communities. 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 sample; furthermore, qualitative information from several sample locations can be vital for understanding the dynamics and trends in local (study area) vegetation patterns (Rodwell, 2006).
- 3.1.4 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.
- 3.1.5 Botanical nomenclature in this report follows that of Stace (2010) for vascular plants and Atherton *et al* (2010) for bryophytes.

4 Survey Constraints and Limitations

- 4.1.1 The NVC survey for Project 8 was carried out from 29 June 2015 to 3 July 2015 inclusive, during the optimal season for habitat surveys. Surveys were carried out by a team of surveyors, over 15 surveyor days, approximately between the hours of 08:00 – 18:00. The weather conditions were amenable to survey – bright, with broken cloud and relatively light winds, and with infrequent light showers. All parts of the study area were accessible and as such there were no constraints on the survey.
- 4.1.2 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 further 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.
- 4.1.3 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.

5 NVC Survey Results and Vegetation

Descriptions

5.1 Summary of NVC Communities

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

- Mires, flushes and springs: M1, M2, M3, M4, M6, M10, M11, M17, M19, M23, M25, M32, M37
- Wet heaths: M15, M16
- Dry heaths: H10, H12, H16, H18, H21
- Grasslands and bracken: U1, U2, U4, U5, U6, U20, MG9, MG10
- Woodland and scrub: W11, W17, W18, W23
- Swamp and tall-herb fens: S9, S19
- Vegetation of open habitats: OV27

5.1.2 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. dry heath) are described in order of community number within the study area.

5.1.3 The survey results are displayed in **Figure 5.1**. A number of target notes were also made during surveys, often to pinpoint springs/flushes, or areas or species of special interest. These target notes are shown in **Figure 5.2** and detailed within Appendix A. Further photographs of a number of the typical habitat types found within the study area are provided within Appendix B.

5.1.4 For each community description, reference is made to any correlation with Annex I habitats, Scottish Biodiversity List (SBL) priority habitats, Cairngorms National Park Authority (CNPA) priority habitats, and potential GWDTE status (as per SEPA guidance). These associations are study area specific, full details and discussion are provided in section 6 below.

5.2 Mires and Flushes

5.2.1 Mires and associated bog pool and flush communities are very common within the study area, often occupying flatter and gently sloping peaty areas. A small number of communities account for a large proportion of the area. These communities are described in further detail below.

M1 *Sphagnum denticulatum* bog pool community

Annex I, SBL, CNPA - Blanket bog

- 5.2.2 This community is confined to pools and wetter hollows on ombrogenous and topogenous mires with base-poor and oligotrophic peat soils in the more oceanic parts of Britain. It is a widespread component in M17 *Trichophorum germanicum* – *Eriophorum vaginatum* blanket mire. This bog pool community typically consists of floating masses or soft wet carpets of *Sphagnum* spp., mainly *Sphagnum denticulatum* and *S. cuspidatum*, with scattered vascular plants growing on or through them or in areas of open water between (Rodwell *et al* 1991; Elkington *et al* 2001).
- 5.2.3 Within the study area some small scattered M1 bog pools were recorded, within areas of M17. The community is easily distinguished on the abundance of *S. denticulatum*. M1 occupied pools that do not become dry in the summer and are unconsolidated. *Sphagnum cuspidatum* is present in some shallow pools and it can form consolidated lawns as well as dense wefts over water. Associated species are sparse and include *Eriophorum angustifolium* and more rarely *Carex rostrata*. The collective area of M1 within the mires is much less than 1% of the mire surface, so they have not been mapped separately.

M2 *Sphagnum cuspidatum/fallax* bog pool community

Communities/sub-communities recorded: M2, M2b

- 5.2.4 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).
- 5.2.5 M2 was rare and localised within the study area, with one sizeable area present consisting of a network of bog pools on flat ground on the lower slopes of Creag Ruadh just north of the Allt Cuaich Burn, around grid reference NN 66070 86974. The vegetation here is dominated by pools and carpets of *S. cuspidatum* and *S. fallax*, with swards of *Eriophorum angustifolium* and *Carex rostrata* growing throughout. This area was in good condition, remaining wet with abundant *Sphagnum* cover, despite grazing and areas of burned heath abutting the community. The **M2b *Sphagnum fallax* sub-community** was also noted sparsely within areas of more extensive blanket mire (see section 5.2.8).

M3 *Eriophorum angustifolium* bog pool community

Annex I, SBL, CNPA - Blanket bog

- 5.2.6 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).

- 5.2.7 Areas of M3 are common within the study area, and are usually found in association with the M17 and M19 mire types, and also with M15 wet heath. The community occurs in places as permanently flooded bog pools within these mires, but more frequently as species-poor continuous swards of *E. angustifolium*. The dominant species in these areas is always *E. angustifolium*, sometimes to the exclusion of all other species. Where other species are present they are sparse and include *Myrica gale*, *Carex echinata*, *C. nigra*, *C. panicea*, *Erica tetralix*, *Eriophorum vaginatum* and occasional *Sphagnum* spp.

M4 Carex rostrata - Sphagnum fallax mire

Annex 1 – Transition mires and quaking bogs; SBL – Upland flushes, fens and swamps; CNPA – Wetlands

- 5.2.8 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 lags 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.
- 5.2.9 M4 is scattered throughout the study area, usually in small stands marking the passage and localised ponding of surface water in depressions. The community is readily recognised within the study area by the tall sward of *Carex rostrata* over a lawn of *Sphagnum fallax* and *S. cuspidatum*, and it varies little from this dominance of the defining species.
- 5.2.10 Other species are limited by the waterlogged substrate and shade from the *C. rostrata*: these species include *Myrica gale*, *Erica tetralix*, *Eriophorum angustifolium* and *Molinia caerulea*. Within the lawns of *Sphagnum* spp., *S. palustre* is occasional and *S. capillifolium* and *S. squarrosum* occur rarely.

Species-poor, waterlogged and unproductive, this community is not subject to any form of management, as there was little evidence of drainage, with the areas also too wet to be of grazing value.

M6 Carex echinata - Sphagnum fallax/denticulatum mire

Communities/sub-communities recorded: M6, M6a, M6b, M6c, M6d

GWDE status – High; SBL – Upland flushes, fens and swamps; CNPA – Wetlands

- 5.2.11 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).

- 5.2.12 M6 is widespread throughout the study area, usually as small flushes, runnels or soakways, and along and within occluding ditches and minor watercourses. All four sub-communities occur within the study area, but most commonly M6a, M6c and M6d.
- 5.2.13 The **M6a *Carex echinata* sub-community** is common and scattered throughout the study area on the lower slopes and floodplain of the River Truim, in association with drainage features or where water has ponded behind palaeoterraces on the floodplain. In this sub-community a sward of sedges grows among an underlying lawn of *Sphagnum fallax*. *Carex echinata* is abundant to frequent, and *C. nigra* and *C. curta* are more occasional in their appearance in the sward. *C. rostrata*, *C. panicea* and *Eriophorum angustifolium* are also occasional to frequent in some stands. Other associates that are occasional to rare in their appearance are *Erica tetralix*, *Molinia caerulea*, *Juncus squarrosus*, *Ranunculus repens*, *Galium palustre*, *Cirsium palustre*, *Viola palustris* and *Angelica sylvestris*. *Sphagnum denticulatum* and *S. palustre* are occasional amongst the *S. fallax*. *Polytrichum commune* is also common.
- 5.2.14 The **M6b *Carex nigra-Nardus stricta* sub community** was recorded on only a couple of occasions, as small runnels. This sub-community is quite similar to the M6a sub-community as described above, but *E. angustifolium* is more prominent and there is very abundant *C. nigra* along with an increased cover of grass species (such as *Anthoxanthum odoratum*) and the rush *Juncus squarrosus*.
- 5.2.15 The **M6c *Juncus effusus* sub-community** is scattered throughout the study area in wet depressions, usually in small, linear extents associated with surface waters and on the floodplain in association with other mire and swamp communities. A tall sward of *J. effusus* over a species-poor lawn of *S. fallax* and *P. commune* indicates this sub-community. The M6c sub-community is very species-poor and uneven. Most of its extent encompasses little more than the three species already listed. Rare to occasional associates include *Galium saxatile*, *G. palustre*, *V. palustris*, *M. caerulea*, *Rumex acetosa*, *S. palustre* and *Potentilla erecta*.
- 5.2.16 The dominance of *Juncus acutiflorus* with a moderately rich but still uneven assemblage of associates distinguishes the **M6d *Juncus acutiflorus* sub-community** from the others within the M6 community. *S. fallax* remains dominant within the extensive moss layer.
- 5.2.17 Associated with the M6d dominants are occasional to rare *Carex rostrata*, *C. panicea*, *C. nigra*, *C. echinata*, *J. squarrosus*, *V. palustris*, *Nardus stricta*, *M. caerulea*, *Festuca rubra*, *P. erecta* and *Deschampsia cespitosa*. These species are no more than occasional in their appearance and the vegetation in places is little more than scattered shoots of *J. acutiflorus* rooted in the lawn of *S. fallax*. Transitions to M23a are also widespread where the two communities occur within mixed mire mosaics, with M6d tending to occupy the line of surface water pathways through areas of M23a.
- 5.2.18 The M6c and M6d sub-communities are of very limited grazing value and of little economic importance. In some places they are associated with drainage but more generally it reflects the topography-influenced passage or retention of surface water.

M10 Carex dioica - Pinguicula vulgaris mire

Communities/sub-communities recorded: M10, M10a

GWDTE status – High; Annex I – Alkaline fens; SBL – Upland flushes, fens and swamps; CNPA - Wetlands

- 5.2.19 The M10 *Carex dioica – Pinguicula vulgaris* mire is a soligenous mire of mineral soils and shallow peats kept very wet by base-rich, calcareous and oligotrophic waters (Rodwell *et al* 1991; Elkington *et al* 2001). The community includes a range of distinctive calcicolous flush vegetation in which the bulk of the sward is composed of small sedges, dicotyledons and bryophytes. It is essentially a small sedge mire and is usually found in small stands. The community typically occurs in unenclosed uplands and most of the stands are grazed and trampled by large herbivores (Rodwell *et al* 1991; Elkington *et al* 2001). The community can occur wherever there is flushing with base-rich water, either below a springhead or where water emerges more diffusely from the ground, most stands being constantly irrigated (Averis *et al* 2004). The M10 mire has much in common with the M11 community described in section 5.2.7, but is distinguished on the presence of a less montane assemblage, notably lacking *Saxifraga aizoides*.
- 5.2.20 This mire was generally recorded to community level, but on some occasions the **M10a *Carex demissa-Juncus bulbosus/kochii* sub-community** was recorded.
- 5.2.21 Within the study area, M10 flushes are scattered throughout a number of habitats, generally on the slopes to the east of the A9. Some areas of M10 vegetation are relatively species-poor, with little more than an open sward of sedges rooted in a lawn of *Sphagnum denticulatum* with occasional *Scorpidium scorpioides*. Where better developed, these species remain frequent to occasional in a fairly evenly mixed assemblage including frequent to occasional *Blindia acuta*, *Campylium stellatum*, *Breutelia chrysocoma*, *Bryum pseudotriquetrum*, *Scorpidium revolvens*, *Sphagnum contortum*, *Narthecium ossifragum*, *Juncus bulbosus*, *Pinguicula vulgaris*, *Carex viridula*, *C. panicea*, *C. nigra*, *C. hostiana*, *Erica tetralix*, *Trichophorum germanicum*, *Eleocharis quinqueflora* and *Drosera rotundifolia*.
- 5.2.22 The presence of acid mire elements such as *N. ossifragum*, *J. bulbosus* and *E. tetralix* is indicative of the M10a sub-community, the other sub-communities being defined by the appearance of more base-demanding and/or distinctive species.
- 5.2.23 These mires are present as threads through other habitats, especially M15b wet heath. Located along a break in slope to the east of the A9 their presence is evidently related to that of a fault line and the movement of groundwater in contact with base-rich rock. This community is a GWDTE, due to its dependency on these base-rich groundwater seepages, which are usually associated with a definite source point. No evident management or deleterious effects on the vegetation were noted.

M11 Carex demissa – Saxifraga aizoides mire

Sub-communities recorded: M11b

GWDTE status – High; SBL – Upland flushes, fens and swamps; CNPA - Wetlands

- 5.2.24 This community is characteristic of open, stony flushes, strongly irrigated with moderately base-rich waters, on generally steep slopes in sub-montane and montane parts of Britain; it is

generally confined to high altitudes and is always associated with calcareous bedrocks (Rodwell *et al* 1991; Elkington *et al* 2001). M11 vegetation is typically open with rich mixtures of small sedges, other herbs and bryophytes among water-scoured runnels and with much exposed silt and rock debris. This community is similar to the M10 community described above; sedges and mosses are similarly prominent but the appearance of montane species, especially *Saxifraga aizoides*, is a key point of distinction.

- 5.2.25 A single area of M11 flushing was recorded in the very northern end of the Project 8 study area, on sloping ground to the east of the A9, around grid reference NN 67857 91501. The M11 here was the less montane **M11b *Cratoneuron commutatum* – *Eleocharis quinqueflora* sub-community**. Within this vegetation *Juncus articulatus*, *Eleocharis quinqueflora* and *Saxifraga aizoides* are frequent in an open sward, with occasional *Narthecium ossifragum*, *Myrica gale*, *Pinguicula vulgaris*, *Carex panicea*, *C. pulicaris*, *C. hostiana*, *Erica tetralix*, *Juncus squarrosus* and *Drosera rotundifolia*. The mosses include frequent *Blindia acuta*, *Campylium stellatum* and *Scorpidium scorpioides*. *Palustriella commutata*, a distinctive moss within this community in Britain, was not recorded.
- 5.2.26 As with the M10 community, M11 is present as threads through other habitats, especially M15b wet heath. Principally located along a break in slope to the east of the A9, their presence is evidently related to that of a fault line and the movement of groundwater in contact with base-rich rock. This community is a GWDTE, due to its dependency on these base-rich groundwater seepages. No evident management or deleterious effects on the vegetation were noted.

M17 Trichophorum germanicum – *Eriophorum vaginatum* blanket mire

Communities/sub-communities recorded: M17, M17a

Annex I, SBL, CNPA – Blanket bog

- 5.2.27 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 2m in depth over flat or gently sloping ground (Rodwell *et al* 1991), however it can also occur extensively on shallower peat. The peats show varying degrees of humification but are typically highly acidic, with a surface pH usually not much above 4 (Rodwell *et al* 1991).
- 5.2.28 This community is dominated by mixtures of monocotyledons, ericoid sub-shrubs and *Sphagnum* spp. It can occur as extensive, relatively uniform tracts, or as hummock and hollow complexes, with this community giving way to bog pool vegetation in the hollows (Rodwell *et al* 1991; Elkington *et al* 2001). Among the bulkier vascular species, the most common are *Trichophorum germanicum*, *Eriophorum vaginatum*, *E. angustifolium*, *Molinia caerulea*, *Calluna vulgaris* and *Erica tetralix*. *Sphagnum* spp. are an important component of the ground layer and can form extensive lawns. Burning, marginal peat-cutting, and drainage have often resulted in surface drying of the peat and hence a modification of the vegetation.
- 5.2.29 M17 is the most common blanket mire type within the study area, with most areas aligning with the **M17a *Drosera rotundifolia*-*Sphagnum* spp. sub-community**. The M17a sub-community is distinguished on the presence of extensive wet lawns of *Sphagnum* spp. and the frequency of *Drosera rotundifolia*.

- 5.2.30 The larger areas of M17a are located on the level floodplain of the River Truim with smaller fragments occupying depressions, level areas and gentle inclines on the slopes above. The vascular vegetation cover is a relatively even assemblage of the grasses and sedges already listed above. *C. vulgaris* is only rarely prominent in the vegetation, over areas of a few square metres. Other species recorded commonly throughout the areas of M17 include *Narthecium ossifragum*, *Potentilla erecta* and *D. rotundifolia*. *Juncus squarrosus* is present in patches.
- 5.2.31 The moss layer within these areas of M17 is dominated by *Sphagna*, especially *S. capillifolium*, *S. subnitens* and *S. papillosum*. *Sphagnum cuspidatum*, *S. fallax* and *S. denticulatum* are locally abundant within the occasional pools and soakways, and other species such as *S. tenellum* are rare to occasional. Where there are low hummocks, pleurocarpous mosses become prominent, often in association with *C. vulgaris*. This assemblage includes *Hylocomium splendens*, *Hypnum jutlandicum* and *Pleurozium schreberi*. Other moss species, including *Aulacomnium palustre* and *Polytrichum commune*, occur occasionally in the wetter parts, typically in association with *S. fallax*.
- 5.2.32 Some small scattered bog pool communities were noted as present within wider areas of M17a. These included:
- M1 *Sphagnum denticulatum* bog pool community
 - M2b *Sphagnum cuspidatum/fallax* bog pool community, *Sphagnum fallax* sub-community.
- 5.2.33 These communities have been described in sections 5.2.1 and 5.2.2 above. The M1 community is easily distinguished on the abundance of *S. denticulatum* and the M2b on the species-poor association of *S. cuspidatum* and *S. fallax*. The collective area of M1 and M2 bog pools is much less than 1% of the mire surface, so generally they have not been mapped separately.
- 5.2.34 The persistence of the bog pools, especially on the larger areas of M17a blanket mire, indicates the relatively good condition of the habitat. It has evidently been reduced in extent on the floodplain by agricultural improvement and probably also by cutting and drainage; grazing of the remaining areas of M17 appears limited.

M19 *Calluna vulgaris* – *Eriophorum vaginatum* blanket mire

Communities/sub-communities recorded: M19, M19a

Annex 1, SBL, CNPA – Blanket bog

- 5.2.35 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 (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).
- 5.2.36 M19 is present within the study area but is not nearly as extensive as M17. It often occurs marginally to the areas of M17 and takes the form of the **M19a *Erica tetralix* sub-community**, giving the appearance of being a degraded form of the former in which tussocks of *E. vaginatum* have become widespread along with an increase in *C. vulgaris* cover, and a decrease in *Sphagnum* spp. abundance and diversity. The presence of M19, marginal to areas of M17, may indicate some drying around the fringes of the M17 mire.

- 5.2.37 As is typical for the community these areas of M19 are co-dominated by *E. vaginatum* and *C. vulgaris*, often resulting in the suppression of the species in between the tussocks so that the associated species are of a low number and low total cover. They include frequent to occasional *Eriophorum angustifolium*, *Erica tetralix*, *Narthecium ossifragum*, *Potentilla erecta* and *Cladonia arbuscula*. *Hylocomium splendens* and *Pleurozium schreberi* are frequent on the tussocks and *Sphagnum capillifolium* and *S. fallax* in damp depressions between tussocks.
- M23 Juncus effusus/acutiflorus – Galium palustre* rush-pasture
- Sub-communities recorded: M23a, M23b
- GWDTE status – High; SBL – Upland flushes, fens and swamps (M23a only); CNPA – Wetlands (M23a) and Wet grasslands (M23b)*
- 5.2.38 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).
- 5.2.39 M23 is not extensive within the study area but forms scattered patches, predominately towards the lower flatter areas around the floodplain of the River Truim. Both sub-communities occur here. Within the study area M23 frequently forms mosaics with the M6 *Carex echinata* - *Sphagnum fallax/denticulatum* mire community (see section 5.2.5).
- 5.2.40 The **M23a *Juncus acutiflorus* sub-community** is the more common of the two sub-communities within the study area. A tall, rush sward dominated by *J. acutiflorus* (*cf. J. effusus*) with a moderately diverse range of herb associates is sufficient to distinguish this sub-community from M23b. Usually associated with surface water movement, this sub-community is commonly linear in nature although it may also form fans where tributaries of the River Truim meet its level floodplain. It is scattered throughout the length of the study area, generally in small areas on the floodplain and the lower parts of the slopes.
- 5.2.41 The field layer beneath the rush sward is highly variable between and within stands, and is strongly influenced by the water level. There are also dynamic areas on the fans where recent channel changes have deposited gravel over the field layer, in some places leaving only the stems of rush visible. Where the field layer beneath the rushes is better developed, there is a variable assemblage of the species listed in the next paragraph: these are widely frequent to occasional but are abundant locally. Among these associated species the grasses are most abundant in relatively dry, marginal areas of the habitat, while more mixed forb-rich assemblages are common in the wetter areas.
- 5.2.42 The species commonly found in this community include: *Carex rostrata*, *C. nigra*, *C. curta*, *Agrostis capillaris*, *A. stolonifera*, *Ranunculus repens*, *Cardamine pratensis*, *Galium palustre*, *Pedicularis palustris*, *Epilobium palustre*, *Potentilla palustris*, *Viola palustris*, *Rumex acetosa* and *Holcus lanatus*. Where the field layer is not overly dense there can be an abundant sward of the

mosses *Calliergonella cuspidata* and *Brachythecium rivulare* and, more occasionally, low mounds of *Aulacomnium palustre* or wefts of *Plagiomnium undulatum*.

- 5.2.43 The **M23b *Juncus effusus* sub-community** is scattered along the lower ground and the edges of the floodplain, within depressions where water collects and alongside minor watercourses and ditches. It is usually associated with grasslands used as pasture and the grass sward makes it attractive to grazing animals. The soft ground conditions mean that it is locally heavily poached.
- 5.2.44 As well as being dominated by *J. effusus*, this sub-community also differs from M23a in being more grassy and less species rich. In the grassy field layer beneath the tall sward of *J. effusus* there is a continuous field layer of collectively abundant *A. stolonifera*, *Poa* spp., *Deschampsia cespitosa* and *H. lanatus*. Where the grass sward is less dense there are small herbs and mosses such as frequent *Brachythecium rivulare*, *Calliergonella cuspidata*, *Ranunculus repens*, *Cardamine pratensis* and *Galium palustre*. More locally, *Angelica sylvestris*, *Myosotis scorpioides*, *Filipendula ulmaria*, *Valeriana officinalis*, *Cirsium palustre* and *Mentha aquatica* are occasional.

M25 Molinia caerulea – Potentilla erecta mire

Communities/sub-communities recorded: M25, M25a

GWDTE status – Moderate; Annex 1, SBL – Blanket bog

- 5.2.45 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 most common are rushes and a few dicotyledons. Occasionally sub-shrubs can be quite common, particularly *Calluna vulgaris* and *Erica tetralix*. *Myrica gale* is local but can be quite extensive and dense in co-dominance with *M. caerulea*. 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).
- 5.2.46 M25 is not overly extensive within the study area, although it is common in smaller patches as marginal areas and in mosaics with blanket bog and wet heaths. There are also a few more continuous extents, usually associated with degraded blanket bog.
- 5.2.47 M25 sub-communities are defined according to the *M. caerulea* associates, and within the study area it generally takes the form of the **M25a *Erica tetralix* sub-community**, indicated here on the presence of a range of wet heath and bog associates (*cf.* grasses or tall herbs indicative of the other two sub-communities).
- 5.2.48 Within the M25 in the study area, *M. caerulea* is typically dominant because of the density of its tall tussocks and leaf litter. The sparse associates include *E. tetralix*, *C. vulgaris*, *Potentilla erecta*, *Juncus* spp. and *Narthecium ossifragum*. *M. gale* is locally abundant and co-dominant in some areas. *Sphagna* are present in some areas and are mainly of the species *S. fallax* and *S. palustre*. In the bases of linear depressions, surface water movement is locally evident in the orientation of the *M. caerulea* litter and the occasional presence of *Carex panicea* and *C. curta*.

5.3 Wet Heaths

- 5.3.1 Wet heath makes up a large proportion of the study area, occupying many gentler sloping areas and flat areas on peat. It forms almost continuous mosaics and transitions with other mire types as well as dry heaths and calcifugous grasslands. Wet heath tends to be found on shallower peats than blanket mire communities; however, this is not always the case due to the impacts of certain treatments (such as grazing and drainage) resulting in the development of wet heath communities on deeper peat (see below).

M15 Trichophorum germanicum – Erica tetralix wet heath

Communities/sub-communities recorded: M15, M15a, M15b, M15c, M15d

GWDTE status – Moderate; Annex I – Northern Atlantic wet heath or blanket bog; SBL – Upland heathland or blanket bog; CNPA – Upland heathland

- 5.3.2 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). The shrubby species *Erica cinerea*, *Vaccinium myrtillus* and *Myrica gale* are important in particular sub-communities. Other species found commonly in M15 are *Potentilla erecta*, *Polygala serpyllifolia*, *Narthecium ossifragum* and *Eriophorum angustifolium*. By contrast *E. vaginatum* is notably scarce. M15 is generally an extremely variable community in terms of dominants, constants and co-dominants, which can vary markedly over short distances. 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).
- 5.3.3 M15 is widespread throughout the whole study area, and shows some considerable variation, highlighted by the presence of all four sub-communities; in order of decreasing abundance, M15b, M15a, M15d and M15c. Each sub-community is discussed further below. M15 within the study area also appears to be present on varying depths of peat. In some cases M15 occupies its natural setting within the landscape on gentler peaty slopes; however the community also appears to be present on areas of deeper peat on flatter ground. In these areas the vegetation may previously have been more referable to the local blanket mire communities, but the flora has been altered by grazing, burning and drainage, thereby facilitating the development of the M15 species assemblage.
- 5.3.4 The **M15a *Carex panicea* sub-community** is more of a soligenous mire than a wet heath (Averis *et al* 2004). It occurs within the study area as obviously more flushed areas within the other sub-communities of M15 and other mires, as well as occurring as some sizeable discrete stands. M15a has a thinner canopy of the characteristic species described above, though within the study area often lacking much *Calluna vulgaris* due to the wetter soils. In the study area this sub-community is distinguished from the other sub-communities of M15 by the presence of species indicative of flushing. Especially characteristic here are the small sedges *Carex panicea*, *C. viridula*

and *C. pulicaris*. *Myrica gale* is also very frequent within many stands of M15a and is often the main canopy sub-shrub. Other species common with M15a are *N. ossifragum*, *E. angustifolium*, *Potentilla erecta*, *Juncus squarrosus*, *C. nigra*, *Drosera rotundifolia*, *Succisa pratensis*, *Pinguicula vulgaris* and the mosses *Sphagnum denticulatum*, *S. capillifolium*, *S. fallax* and, locally, *Scorpidium scorpioides*.

- 5.3.5 By far the most common sub-community of M15 within the study area is the **M15b Typical sub-community**, which is extensive in many parts of the study area. M15b here consists of a sward with variable amounts of the main characteristic species: *Calluna vulgaris*, *Molinia caerulea*, *Trichophorum germanicum* and *Erica tetralix*. The relative proportions of these species can be very varied within small areas, and each one of these species can attain local dominance. *Myrica gale* is also frequent and sometimes locally dominant within this shrubby canopy. Many other species are frequently to occasionally scattered in these M15b heaths; they include *Carex panicea*, *C. binervis*, *C. nigra*, *C. pauciflora*, *C. echinata*, *C. curta*, *Narthecium ossifragum*, *Juncus squarrosus*, *Eriophorum angustifolium*, *Nardus stricta*, *Anthoxanthum odoratum*, *Luzula multiflora*, *Festuca ovina*, *F. vivipara*, *Dactylorhiza maculata*, *Potentilla erecta*, *Galium saxatile* and *Blechnum spicant*. *E. vaginatum* is only a sparse occasional. Very locally, where there is some evident surface flow, there can be a tall, open sward of *Juncus acutiflorus* rooted within the sub-community with no other discernible floristic differences from the surrounding M15b vegetation.
- 5.3.6 The M15b field layer often contains much *M. caerulea* litter among and beneath the vascular plants, but in this same zone mosses can be common, with the following species found in varying abundances: *Sphagnum capillifolium*, *S. fallax*, *S. subnitens*, *S. palustre*, *Dicranum scoparium*, *Plagiothecium undulatum*, *Aulacomnium palustre*, *Hypnum jutlandicum*, *Pleurozium schreberi*, *Hylocomium splendens*, *Rhytidiadelphus squarrosus* and *Polytrichum commune*. *Cladonia* spp. (lichens) are locally abundant. *Sphagnum cuspidatum*, *S. denticulatum*, *S. fallax* and *S. palustre* are locally frequent to abundant in wet depressions and soakways. *Sphagnum papillosum*, *S. compactum* and *S. tenellum* are generally only occasional.
- 5.3.7 The **M15c *Cladonia* spp. sub-community** is uncommon within the study area. M15c is drier than M15a and M15b and in the study area has a generally more open sward, with *Calluna vulgaris* often the most abundant of the four main constituent species and typically growing with *Trichophorum germanicum* and locally a little *Erica cinerea*. The ground layer largely lacks the *Sphagna* of the wetter sub-communities which are generally replaced here by mixes of pleurocarpous mosses, *Racomitrium lanuginosum*, *Sphagnum compactum* and the lichens *Cladonia arbuscula*, *C. portentosa* and *C. uncialis*.
- 5.3.8 A number of areas of the **M15d *Vaccinium myrtillus* sub-community** were also recorded within the study area. Like M15c this sub-community is at the drier end of the M15 continuum, although it contains more graminoids. These areas of M15d are characterised by *Calluna vulgaris*, *Trichophorum germanicum*, *Erica tetralix* and *Potentilla erecta*, with scattered shoots of *Vaccinium myrtillus*, although this species was rare in some stands. *Molinia caerulea* is scarce throughout M15d.
- 5.3.9 Many stands are heavily dominated by *T. germanicum*, although locally *Anthoxanthum odoratum* and/or *Deschampsia flexuosa* are co-dominant but subordinate to the cover of *T. germanicum*. Between the tussocks of *T. germanicum* a number of other species are frequent to occasional. These include *Juncus squarrosus*, *Nardus stricta*, *Narthecium ossifragum*, *Carex panicea*, *Polygala serpyllifolia*, *Luzula multiflora*, *Pedicularis sylvatica*, *Galium saxatile* and *Festuca ovina*. *Sphagna* are rare apart from occasional *S. capillifolium*; pleurocarpous mosses dominate in the bryophyte layer.

- 5.3.10 Also included within this M15d heath are areas that have been grazed to the point where the sward is almost completely dominated by *T. germanicum*. *N. stricta* is frequent in these situations as well as occasional species evidently derived from wet heath, such as *E. tetralix*, *M. caerulea* and *P. erecta*. *Hylocomium splendens* and *Hypnum jutlandicum* dominate the moss layer here, with occasional *Cladonia arbuscula* and *Racomitrium lanuginosum* on hummocks; there are occasional small, persistent pockets of *S. capillifolium*.
- 5.3.11 This degraded form of wet heath, represented here by the M15d sub-community, is one that has been influenced by grazing. This alters the vegetation composition through selective grazing of plants and trampling of sensitive *Sphagnum* species. M15d is especially sensitive to these influences because its stands occupy the drier end of the M15 hydrological continuum.

The M15 community as a whole has been impacted by burning, grazing and drainage.

M16 *Erica tetralix* – *Sphagnum compactum* wet heath

Communities/sub-communities recorded: M16, M16d

GWDTE status – High; Annex I – Northern Atlantic wet heath or blanket bog; *SBL* – Upland heathland or blanket bog; *CNPA* – Upland heathland

- 5.3.12 This wet heath community is found on acid and oligotrophic mineral soils or shallow peats that are moist and at least seasonally waterlogged. M16 typically occurs on sloping ground, although it can cover almost level ground too. In Scotland it extends onto thin ombrogenous peats at higher altitudes. Grazing and burning are important in maintaining the vegetation (Rodwell *et al* 1991; Elkington *et al* 2001). This community is characteristically dominated by mixtures of *Erica tetralix*, *Calluna vulgaris*, *Trichophorum germanicum* and *Molinia caerulea*, but their proportions are very variable, being influenced by differences in the water regime and trophic state of the soils, and also by grazing and burning.
- 5.3.13 In the study area M16 was found on damp, peaty soils in two areas of level valley floor, in association with M15b wet heath, H12 dry heath and MG10a rush-pasture. This M16 vegetation consists mainly of *Calluna vulgaris*, *Erica tetralix* and *Trichophorum germanicum*, with other species including *Juncus squarrosus*, *Molinia caerulea*, *Carex pilulifera*, the mosses *Hypnum jutlandicum*, *Campylopus introflexus* and *Sphagnum compactum*, and lichens of the genus *Cladonia*. The heath is rather species-poor compared with most of the M15 in the study area. Many species which are common in M15 (at least in some M15 sub-communities) are scarce or absent here: for example *Potentilla erecta*, *Sphagnum capillifolium*, *Carex panicea*, *Myrica gale*, *Erica cinerea* and *Racomitrium lanuginosum*. This species-poor flora appears to be the result of previous burning. The vegetation is moderately grazed. At the sub-community level these stands of M16 belong to the **M16d *Juncus squarrosus*-*Dicranum scoparium* sub-community**.

5.4 Dry Heaths

- 5.4.1 There are substantial areas of dry heath present within the study area, particularly on the higher, steeper and drier slopes to the east of the existing A9. Many areas of dry heath have been burned, resulting in mosaics of dry heath with secondary regenerating heath and patches of calcifugous grasslands. The dry heath also commonly forms mosaics and transitions with various mires, wet heath and grassland communities. The dry heath across most of the study area is

dominated by *Calluna vulgaris*. Five recognised dry heath NVC communities have been identified within the Project 8 study area, as per below.

H10 *Calluna vulgaris* – *Erica cinerea* heath

Communities/sub-communities recorded: H10, H10c

Annex 1 – European dry heaths; SBL, CNPA – Upland heathland

5.4.2 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 zonation's and mosaics with grasslands, other heath types and mire communities (Rodwell *et al* 1991; Elkington *et al* 2001).

5.4.3 H10 was recorded in only two small polygons within the study area. In one area no sub-community was assigned and the vegetation is dominated by a canopy of *C. vulgaris* and *E. cinerea*, with *Galium saxatile* and *Potentilla erecta* and a carpet of pleurocarpous mosses. Less frequent additional associates included *Agrostis capillaris*, *Nardus stricta*, *Carex binervis* and *Blechnum spicant*. A single very small area of the more grassy **H10c *Festuca ovina* – *Anthoxanthum odoratum* sub-community** was recorded among U4 acid grassland on a south-east facing slope just west of the River Truim, north of Dalwhinnie. The great abundance of grasses in the sward indicates the H10c sub-community.

H12 *Calluna vulgaris* – *Vaccinium myrtillus* heath

Communities/sub-communities recorded: H12, H12a, H12c

Annex 1 – European dry heaths; SBL, CNPA – Upland heathland

5.4.4 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 a more open cover of degenerate *C. vulgaris* can often also be present. *Vaccinium myrtillus* is constant though it is usually subordinate to *C. vulgaris*. 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.

5.4.5 Within the study area the H12 vegetation consists of dense canopies of *C. vulgaris* with shoots of *V. myrtillus* where the former is not overly dominant. There can also be other sub-shrubs, especially after a fire when the heather is recovering. Herbs are usually inconspicuous below the canopy, and there is a dense carpet of pleurocarpous mosses including *Hylocomium splendens*, *Hypnum jutlandicum*, *Pleurozium schreberi* and *Rhytidiadelphus loreus*.

5.4.6 Two H12 sub-communities were identified during the surveys. The **H12a *Calluna vulgaris* sub-community** is the more common of the two. This sub-community is the typical form of dry heather moor that is usually managed for red grouse. It is characterised by a quite species-poor species assemblage. It is extensive along the length of Project 8. The slopes to the east of the A9 have the most extensive cover where the topography of mounds, ridges and steep slopes provides the appropriate free-draining conditions, with wet heath and blanket bog occupying the

intervening depressions, flats and hollows. However, small areas of H12a and other forms of dry heath are also located on the flood plain of the River Truim where appropriate topographic conditions and levels of grazing allow.

- 5.4.7 The vegetation of a considerable proportion of the H12a is of relatively low quality and little more than *C. vulgaris* over a lawn of pleurocarpous mosses, with *V. myrtillus* and the other associates present only where the canopy is less dense or where burning has evidently taken place. Where the *Calluna* canopy is less dense, *Erica cinerea* and *Arctostaphylos uva-ursi* can become more widespread, as well as a number of other species that are otherwise rare beneath the heather canopy: such species include *Vaccinium vitis-idaea*, *Carex binervis*, *Galium saxatile*, *Polygala serpyllifolia* and *Potentilla erecta*. The moss layer is dominated by *Hylocomium splendens* and *Hypnum jutlandicum* with occasional *Plagiothecium undulatum*, *Pleurozium schreberi*, *Rhytidiadelphus loreus*, *R. triquetrus* and in places *Cladonia* spp. (lichens). Other infrequent associates included *Blechnum spicant*, *Juncus squarrosus*, *Nardus stricta*, *Erica tetralix* and *Molinia caerulea* as sparse plants, often in proximity to wetter heaths and mires. In many areas of H12a *V. myrtillus* is locally absent, the vegetation therefore resembling H9 *Calluna vulgaris* – *Deschampsia flexuosa* heath but with a more diverse assemblage of pleurocarpous mosses. This form of the H12 community is associated with grouse moor and management by burning, although sheep may graze as well, albeit at a low density.
- 5.4.8 The **H12c *Galium saxatile* – *Festuca ovina* sub-community** was also commonly recorded within the study area. In this sub-community relatively high levels of grazing reduce the cover of the *Calluna vulgaris* canopy and the vegetation takes on a more grassy appearance. Elements of U4 and U5 calcifugous grasslands then become more established. The *C. vulgaris* cover is variable within this sub-community but it is short (<20 cm) to prostrate in places, depending upon the level of grazing. In open areas the grasses dominate, especially *Nardus stricta*, *Festuca ovina*, *F. rubra*, *Anthoxanthum odoratum*, *Deschampsia flexuosa*, *Agrostis capillaris* and *A. canina*. *Juncus squarrosus* is locally frequent and the typical small herbs *Galium saxatile* and *Potentilla erecta* scramble throughout with the reduced levels of shade from the *C. vulgaris*. *Erica tetralix*, *Trichophorum germanicum* and *Carex binervis* are scarce. This sub-community is associated with pastoral management.

H16 *Calluna vulgaris* – *Arctostaphylos uva-ursi* heath

Communities/sub-communities recorded: H16, H16a, H16b

Annex 1 – European dry heaths; SBL, CNPA – Upland heathland

- 5.4.9 H16 *Calluna vulgaris* – *Arctostaphylos uva-ursi* heath is a typical sub-shrub community of circumneutral to base-poor soils at moderate altitudes, and is generally found between 240 m and 600 m altitude in the cold continental climate of the east-central Highlands, with especially good representation around Speyside (Rodwell *et al* 1991; Elkington *et al* 2001). H16 is characterised by the relative abundance of *A. uva-ursi* alongside typical heath vegetation including *C. vulgaris*, and in lower abundances *Erica cinerea*. It is an important part of grouse moor in the east-central Highlands (Elkington *et al* 2001). H16 has a relatively rich range of associates ranging from species typical of heath through to those more typical of mesotrophic conditions; *Genista anglica* is a distinctive associate. In the eastern Highlands this vegetation type is often a secondary heath resulting after burning, which maintains this vegetation as a plagioclimax community (Elkington *et al* 2001; Averis *et al* 2004).

- 5.4.10 In the study area, this community is present within burnt areas of an intermediate age (as regards the burning regime) within in larger areas of H12a heath. During recovery from burning, the dominance of *C. vulgaris* is gradually restored so that away from the burns *A. uva-ursi* is found as diminutive shoots beneath the former's canopy. As such, H16 heath is evidently transitory, occupying a middle to late stage in the succession from burn to restoration of the H12 *C. vulgaris* canopy. Two sub-communities are present, as described below.
- 5.4.11 **H16a *Pyrola media*-*Lathyrus montanus* sub-community** is the herb-rich form of this heath, including a range of mesotrophic species such as *Lathyrus montanus*, *Viola riviniana* and *Pyrola media*. The species richness of this sub-community in the study area is not particularly high. This is especially so in the earliest stages of its establishment when it generally replaces a grass sward dominated by *Festuca ovina* (see NVC community U1 below) and *Deschampsia flexuosa*. These two grasses are gradually displaced and joined by *Lotus corniculatus*, *Carex panicea*, *P. media*, *Genista anglica*, *Anthoxanthum odoratum* and *Anemone nemorosa*, as well as the regenerating sub-shrubs.
- 5.4.12 The **H16b *Vaccinium myrtillus*-*Vaccinium vitis-idaea* sub-community** was also frequently recorded. This sub-community is identified on the clear co-dominance of *A. uva-ursi* and *C. vulgaris* and its more species-poor assemblage lacking mesotrophic herbs.
- 5.4.13 The heath like elements of H16b within the study area include *Erica cinerea*, *Agrostis capillaris*, *A. canina*, *Galium saxatile*, *Carex pilulifera*, *Festuca ovina*, *Potentilla erecta* and *Deschampsia flexuosa*. Shoots of *Vaccinium myrtillus* are common in places, as well as the regenerating shrubs of *A. uva-ursi* and *C. vulgaris*. Pleurocarpous mosses (especially *Hylocomium splendens*, *Hypnum jutlandicum* and *Pleurozium schreberi*) form a weft between the vascular plants, and depending upon the time since burning there may be areas of bare peat.

H18 *Vaccinium myrtillus* – *Deschampsia flexuosa* heath

Communities recorded: H18

Annex I – European dry heaths; SBL, CNPA – Upland heathland

- 5.4.14 H18 *Vaccinium myrtillus* – *Deschampsia flexuosa* heath is typical of moist but free draining acid to neutral mineral soils, humic rankers and dry peats over steeper slopes at moderate to high altitudes (Rodwell *et al* 1991; Averis *et al* 2004). H18 includes a variety of moss-rich and grassy sub-shrub vegetation in which *V. myrtillus* is the most frequent and generally the most abundant ericoid (Rodwell *et al* 1991; Elkington *et al* 2001). H18 can be a near-natural heath, or one clearly anthropogenic, it is common at lower altitudes as a derivative of H12 *Calluna vulgaris* – *Vaccinium myrtillus* heath where the H12 heaths are burned and then grazed too hard to allow *Calluna vulgaris* to re-establish (Rodwell *et al* 1991; Averis *et al* 2004).
- 5.4.15 Two small areas of H18 were recorded within the study area to the east of the A9 on the lower western slopes of Creag Ruadh. In these areas localised burning and grazing of H12 heath has evidently resulted in conversion to H18 *Vaccinium* – *Deschampsia* heath.
- 5.4.16 In these areas *V. myrtillus* dominates along with *D. flexuosa* and *Potentilla erecta*. *C. vulgaris* is present in a short cropped and heavily grazed form. Other associates present within the H18 heath include *Galium saxatile*, *Festuca ovina*, *Nardus stricta*, *Agrostis capillaris* and *Anthoxanthum odoratum*. Mosses included *Hypnum jutlandicum*, *Hylocomium splendens* and *Pleurozium schreberi*.

H21 - *Calluna vulgaris* – *Vaccinium myrtillus* – *Sphagnum capillifolium* heath

Sub-communities recorded: H21a

Annex 1 – European dry heaths; SBL, CNPA – Upland heathland

- 5.4.17 The H21 community generally has a mixed canopy of sub-shrubs, usually 30-50 cm high, with a damp layer of luxuriant bryophytes. *Calluna vulgaris* is usually the dominant ericoid, although *Vaccinium myrtillus* is constant. Bryophytes form an extensive and lush carpet; particularly distinctive is the high frequency and local abundance of *Sphagnum capillifolium* (Rodwell *et al* 1991; Elkington *et al* 2001). This heath is highly characteristic of fragmentary humic soils in situations with a cool but equable climate and a consistently shady and extremely humid atmosphere. It is widespread at low to moderate altitudes in upland Britain. It is found mainly on steep, sunless slopes of north-west to easterly aspect, often with rock outcrops (Rodwell *et al* 1991; Elkington *et al* 2001).
- 5.4.18 Only a single very small area of H21 was recorded within the Project 8 study area. This belongs to the **H21a *Calluna vulgaris*-*Pteridium aquilinum* sub-community**. The vegetation consists of dominant rank *C. vulgaris* with occasional shoots of *V. myrtillus* and some *Blechnum spicant* over an extensive carpet of *S. capillifolium* with some scattered *Hylocomium splendens* and *Pleurozium schreberi*.

5.5 Springs

M32 *Philonotis fontana* – *Saxifraga stellaris* spring

Communities/sub-communities recorded: M32, M32a

GWDTE status – High; SBL – Upland flushes, fens and swamps; CNPA – Wetlands

- 5.5.2 M32 is a community of springs and rills at moderate to high altitudes, mainly from 450 m to over 1000 m, where there is irrigation with circumneutral and oligotrophic waters. This is one of the most common and widespread types of spring vegetation in the uplands of north-west Britain and is dependent on sustained and vigorous irrigation by groundwater (Rodwell *et al* 1991; Elkington *et al* 2001). The community is common through the Scottish Highlands. These bryophyte-dominated springs, flushes and rills are striking in appearance; *Philonotis fontana* is usually dominant and obvious by its bright green colour.
- 5.5.3 A number of M32 springs were recorded on the slopes above the A9, and are generally of the **M32a *Sphagnum denticulatum* sub-community**. The dominant species within these springs are *Philonotis fontana*, *Dichodontium palustre*, *Sphagnum denticulatum* and *Scapania undulata*. In some springs there are occasional plants of other species including *Saxifraga stellaris*, *Viola palustris*, *Pinguicula vulgaris*, *Thalictrum alpinum*, *Montia fontana*, *Calluna vulgaris* and *Carex panicea*.
- 5.5.4 These small areas of habitat are resistant to burning and grazing because of their wet and unproductive nature. The heath around one of the springs was recently burnt without any effect on the spring vegetation. This community is a GWDTE, due to its dependency on more base-enriched groundwater upwellings.

M37 *Palustriella commutata* – *Festuca rubra* spring

GWDTE status – High; *SBL* – Upland flushes, fens and swamps; *CNPA* – Wetlands

- 5.5.5 M37 is a community found on ground kept permanently moist by irrigation with base-rich, calcareous and generally oligotrophic waters. It is dependent on sustained irrigation and is fairly common in areas of higher rainfall. It marks out spring-heads, seepage lines and drip zones in areas of lime-rich bedrocks, where waters emerge along bedding planes or at junctions with impervious substrates. The community can be found throughout the north-western uplands of Britain (Rodwell *et al* 1991; Elkington *et al* 2001).
- 5.5.6 A single M37 spring was recorded within the study area. As is typical, it was dominated by dense formations of *Palustriella commutata* mixed with smaller amounts of *Philonotis fontana*. Scattered very thinly among the extensive spongy carpets of these mosses are various vascular species: *Cirsium palustre*, *Carex flacca*, *Festuca rubra*, *Holcus lanatus*, *Equisetum palustre* and *Epilobium anagallidifolium*.
- 5.5.7 This community is a GWDTE, due to its dependency on base-enriched groundwater upwellings.

5.6 Calcifugous Grasslands and bracken-dominated vegetation

U1 *Festuca ovina* – *Agrostis capillaris* – *Rumex acetosella* grassland

Sub-communities recorded: U1e

- 5.6.2 U1 is characteristic of thin, base-poor, oligotrophic and summer-parched soils. It is generally a lowland community but can extend as scattered patches into the uplands. It tends to have an open sward of small tussocky grasses among which there can be an abundance of dicotyledons. The sward usually contains *Agrostis capillaris*, *Aira praecox* and *Festuca ovina* with frequent to occasional *Rumex acetosella*. Grazing and disturbance are typically important contributory factors in maintaining the open structure of the vegetation (Rodwell *et al* 1992; Cooper, 1997).
- 5.6.3 U1 was recorded in a few localities on slopes within the study area, where it is more specifically the **U1e *Galium saxatile*-*Potentilla erecta* sub community** as indicated by the ‘heathy’ association of *G. saxatile*, *P. erecta* and *Deschampsia flexuosa*.
- 5.6.4 The U1e sub-community within the study area is established where burning of the H12 dry heath community has taken place. Other than the dominant *F. ovina*, the species already listed are occasional in their appearance as well as regenerating heath species, especially *Erica cinerea*, *Vaccinium vitis-idaea*, *Erica tetralix*, *Polygala serpyllifolia* and *Calluna vulgaris*.
- 5.6.5 Owing its origins to burning of H12a heath sub-community, the U1e sub-community is transitory and in the process of succession to its original H12a form. It is of economic value as a component of grouse moor.

U2 *Deschampsia flexuosa* grassland

Sub-communities recorded: U2b

- 5.6.6 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).

- 5.6.7 In this survey, the U2 community was found in association with burnt heath. Typically, *D. flexuosa* formed the dominant cover and there were a number of heath-related elements present that will replace the *D. flexuosa* during the succession back to heathland. These elements include a species-poor assemblage of occasional to rare *Vaccinium myrtillus*, *Calluna vulgaris*, *Juncus squarrosus*, *Festuca ovina* and the mosses *Hylocomium splendens*, *Hypnum jutlandicum* and *Pleurozium schreberi*. These species collectively indicate the **U2b *Vaccinium myrtillus* sub-community**. Present in one location only within the study area, this U2b grassland will soon be replaced by heath. However, new areas of U2b will probably become established by the ongoing burning regime for grouse management.

U4 *Festuca ovina* – *Agrostis capillaris* – *Galium saxatile* grassland

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

- 5.6.8 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 other grasslands, heaths, and mires.
- 5.6.9 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 described below it may be limited by the dense, relatively productive sward of grasses.
- 5.6.10 U4 is widespread along the length of the study area. It covers both extensive areas that are enclosed for grazing and smaller discrete patches in mosaics with mire, heath and other grassland communities. In the latter case the U4 grasslands often occupy the best-drained situations that are subject to grazing by sheep. Two sub-communities are widespread within the study area, as described below.
- 5.6.11 The **U4a Typical sub-community** is relatively species-poor and it has no distinguishing species. The sward is often thick with mosses, and *G. saxatile* and *P. erecta* are very common. Within the study area, U4a is generally associated with extensive grazing and smaller areas juxtaposed with other types of habitat. It is strongly associated with dry heath (especially H12a) from which it is probably derived through the influence of grazing; it also occurs on raised, free-draining, mineral mounds protruding through wet heath, blanket bog and other forms of mire.
- 5.6.12 The main sward of *Agrostis capillaris*, *Festuca ovina* and *Anthoxanthum odoratum* is enriched in places by *Cynosurus cristatus*, *Nardus stricta* and *F. rubra* in association with a limited number of frequent to occasional associates. *Galium saxatile* and *Potentilla erecta* are consistent and the following herbs are widely present: *Luzula multiflora*, *Carex pilulifera*, *Cerastium fontanum*, *Ranunculus repens*, *Rumex acetosella* and *R. acetosa*. The following species occur more rarely though they may be locally frequent to occasional: *Taraxacum* spp., *Luzula campestris*, *Viola riviniana*, *Veronica chamaedrys*, *Campanula rotundifolia*, *Carex panicea*, *Deschampsia flexuosa*, *Calluna vulgaris*, *Galium verum*, *Senecio jacobaea*, *Plantago lanceolata*, *Alchemilla alpina* and

Achillea millefolium. Occasionally there are some sprigs of *Thymus praecox*, but not enough to classify the vegetation as CG10 *Festuca ovina* - *Agrostis capillaris* - *Thymus praecox* grassland. Where the cover of vascular species is open, there are mounds of pleurocarpous mosses, especially *Rhytidiadelphus squarrosus*, as well as more occasional *Brachythecium rutabulum*, *Hylocomium splendens*, *Kindbergia praelonga* and *Pleurozium schreberi*.

- 5.6.13 Moderate levels of grazing are responsible for the maintenance of this sub-community, whose derivation from dry heath is apparent in its close juxtaposition with heath as well as the localised persistence of close-cropped, spindly heather within the U4a. Under more intensive levels of grazing, potentially in association with liming and/or fertiliser applications, the U4b sub-community described below is present.
- 5.6.14 The **U4b *Holcus lanatus*-*Trifolium repens* sub-community** is also widespread within the study area, especially at lower altitudes. Some agricultural improvement is evident in the U4b sub-community. This is most apparent in the presence of a relatively productive, broad-leaved grass sward with dominant mixtures of *A. capillaris*, *F. ovina* and *H. lanatus*. In season, the flowers of frequent to abundant *T. repens* serve as another point of distinction.
- 5.6.15 Dependent on relatively fertile conditions to maintain its productivity, this community is generally confined to the floodplain of the River Truim and the more accessible lower slopes above. Small patches of grassland amongst heath are usually referable to the U4a sub-community whereas U4b forms more continuous extents that may have been derived by means other than grazing alone in the past.
- 5.6.16 The swards within the study area are dominated by mixtures of *Agrostis capillaris*, *Poa* spp., *Festuca rubra*, *F. ovina*, *Anthoxanthum odoratum* and *Holcus lanatus*; in some stands *H. lanatus* is very abundant and dominates the sward. *Trifolium repens* is frequent and abundant locally. Associates include frequent to occasional: *Cerastium fontanum*, *Cynosurus cristatus*, *Lolium perenne*, *Plantago lanceolata*, *Ranunculus repens*, *R. acris*, *Cirsium arvense*, *Luzula campestris*, *Veronica chamaedrys*, *Juncus effusus*, *Deschampsia cespitosa* and *Achillea millefolium*.
- 5.6.17 Valuable as pasture, this community is managed by relatively continuous grazing although other treatments such as ploughing, re-seeding and fertiliser applications may have been applied in the past to bring it into its 'semi-improved' condition.

U5 *Nardus stricta* – *Galium saxatile* grassland

Communities/sub-communities recorded: U5, U5a, U5b, U5c

U5c only: Annex I – Species-rich Nardus grassland; SBL – Upland calcareous grassland; CNPA - Grasslands

- 5.6.18 U5 grassland tends to be found on damp mineral soils which have peaty upper horizons. It typically occupies slopes where the depth and wetness of the soil are intermediate between the drier podsoils under U4 grasslands and wet shallow peats found under U6 grassland. The underlying rock can be anything from acid to basic, but the soils are generally acidic (Rodwell *et al* 1992; Averis *et al* 2004). U5 is common over the higher hill slopes of the cool, wet north and west of Britain (Rodwell *et al* 1992; Cooper, 1997). U5 is also commonly found on well-drained but moist alluvial soil along the margins of streams (Averis *et al* 2004).

- 5.6.19 The sward of the U5 community is dominated by *Nardus stricta* in association with the same main species as listed for U4 above, albeit at a lower cover. The prominence of *N. stricta* defines U5 and the appearance of additional species defines some of the sub-communities.
- 5.6.20 U5 is very common within the study area, occupying all types of habitat including stands from the banks of the River Truim through to the upper slopes where it is commonly found in mosaics with other calcifugous grasslands and dry heath. Three sub-communities of U5 were recorded within the study area. U5a is by far the most abundant of these, but there are some stands of U5b and two very small areas of U5c, as described below.
- 5.6.21 The **U5a Species-poor sub-community** is widespread and lacks any of the species distinctive to the other sub-communities; U5a is readily identified on this basis alone. The sward is dominated almost exclusively by *Nardus stricta* and its litter, and the sub-community is visible from a distance on the basis of its light appearance. *Agrostis capillaris* and *Anthoxanthum odoratum* can be locally abundant to frequent, and the following species are generally occasional: *Lotus corniculatus*, *Vaccinium myrtillus*, *Ranunculus repens*, *Alchemilla alpina*, *Galium saxatile*, *Viola riviniana*, *Polygala serpyllifolia*, *Potentilla erecta* and *Holcus lanatus*. *Anemone nemorosa* is rarely present. Mosses such as *Hypnum jutlandicum*, *Hylocomium splendens* and *Pleurozium schreberi* are common.
- 5.6.22 The U5a sub-community commonly forms small patches within H12 heath or U4 grassland on steep, well drained slopes that limit the productivity of the vegetation. The low productivity combined with the dominance of the unpalatable *Nardus stricta* means that grazing of the community is limited.
- 5.6.23 A few areas of the **U5b *Agrostis canina*-*Polytrichum commune* sub-community** were also recorded. This sub-community is present on wetter substrates than the U5a sub-community and is distinguished floristically by the prominence of *Luzula multiflora*, *Juncus squarrosus*, *Agrostis canina* and the moss *Polytrichum commune*.
- 5.6.24 *Sphagnum* is a frequent small component of the U5b sub-community in the study area. *Sphagnum capillifolium* forms most of the *Sphagnum* cover here but there is also occasional *S. papillosum* and *S. fallax*, all three species persisting in small (<1 m in any dimension) wet depressions. *Polytrichum commune* is frequent to locally abundant. The vascular species listed above are abundant to frequent. The rosette species, including *J. squarrosus*, are especially prominent because of the grazing to which the sub-community is subject. Other species include occasional *Galium saxatile*, *Potentilla erecta*, *Molinia caerulea* and the usual range of pleurocarpous mosses including *Hypnum jutlandicum*, *Hylocomium splendens* and *Pleurozium schreberi*.
- 5.6.25 Two very small areas of the **U5c *Carex panicea*-*Viola riviniana* sub-community** were recorded. This sub-community is characteristic of places where the U5 grassland is more flushed and the soils are thereby mildly base-enriched, allowing a number of mesotrophic species to be present.

U6 *Juncus squarrosus* – *Festuca ovina* grassland

Communities recorded: U6

GWDTE Status – Moderate

- 5.6.26 U6 *Juncus squarrosus* - *Festuca ovina* grassland is characteristic of moist peats and peaty mineral soils, almost always base-poor and infertile, over gentle slopes and plateaux at higher altitudes (400 m to 800 m) in the cool and wet north and west of Britain (Rodwell *et al* 1992; Cooper,

1997). U6 is often a secondary vegetation type, strongly encouraged by particular kinds of grazing and burning treatments in damper upland pastures and on the drying fringes of blanket mires. The spread of *J. squarrosus* in upland pastures tends to be encouraged where uncontrolled heavy and selective grazing has been applied over rather ill-drained ground (Rodwell *et al* 1992; Cooper, 1997).

- 5.6.27 Only a few small areas of U6 were recorded within the study area. These are mostly juxtaposed with mire and acid grassland communities. As such, U6 represents a grazing-modified form of habitat. This grassland was mapped only to community level because of the presence of characteristics attributable to more than one sub-community. As would be expected *J. squarrosus* was the dominant species in each stand. The damper conditions supported *Sphagnum* spp. (indicative of U6a *Sphagnum* sub-community) as well as *Aulacomnium palustre*, *Carex nigra* and *Plagiothecium undulatum* (indicative of U6b *Carex nigra-Calypogeia azurea* sub-community; the rare liverwort *C. azurea* was not found). *Festuca ovina* is frequent to locally abundant, and *Eriophorum vaginatum*, *Anthoxanthum odoratum* and *Agrostis canina* are occasional. *Galium saxatile* and *Potentilla erecta* are occasional to locally frequent. These vascular species and their cover are also intermediate between U6a and U6b.

U20 *Pteridium aquilinum* – *Galium saxatile* community

Sub-communities recorded: U20a

- 5.6.28 The U20 *Pteridium aquilinum* – *Galium saxatile* community occurs on well aerated and often moist soils which are base-poor to circumneutral (Rodwell *et al* 1992; Cooper, 1997). *Pteridium aquilinum* is the sole dominant and is overwhelmingly abundant in some stands. This is a community of little ecological value.
- 5.6.29 This community is infrequent within the study area, and it extends over small areas on the edge of the floodplain and on the lowermost slopes. It does not appear to be subject to any form of management or control.
- 5.6.30 The U20 vegetation present within the study area belongs to the more grass-rich **U20a *Anthoxanthum odoratum* sub-community**. *P. aquilinum* dominates but is generally associated with a field layer of grassland related to the U4 community. There is frequent to locally abundant *Agrostis capillaris*, *Festuca ovina*, *F. rubra*, *Anthoxanthum odoratum* and *Holcus lanatus*. *Viola riviniana*, *Veronica chamaedrys*, *Galium saxatile*, *Potentilla erecta* and *Rumex acetosa* are more occasional in their appearance. The moss layer is well developed, especially where the shade of the *P. aquilinum* limits the cover of grasses. *Rhytidiadelphus squarrosus* is abundant with frequent *Hypnum jutlandicum* and *Pseudoscleropodium purum*.

5.7 Mesotrophic Grasslands

MG9 *Holcus lanatus* – *Deschampsia cespitosa* grassland

Sub-communities recorded: MG9a

GWDTE Status – Moderate; *CNPA* – Wet grasslands

- 5.7.2 MG9 *Holcus lanatus* – *Deschampsia cespitosa* grassland is highly 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 usually contains a coarse and tussocky sward dominated by *D. cespitosa* (Rodwell *et al.*, 1992; Cooper, 1997).

- 5.7.3 MG9, and more specifically the **MG9a *Poa trivialis* sub-community**, is patchily distributed along the length of the study area and is often included within mapped mosaic polygons on account of its patchy distribution. The MG9a sub-community has a relatively open sward (maintained by grazing) and a moderate richness of associates. The vegetation is dominated by *D. cespitosa*, and *Holcus lanatus* is locally abundant between the tussocks. Within the sward established by these two grasses, other species are occasional to locally frequent, including *Ranunculus acris*, *R. repens*, *Cardamine pratensis*, *Alchemilla glabra*, *Equisetum arvense*, *Stellaria uliginosa*, *Senecio jacobaea*, *Poa trivialis*, *Juncus effusus*, *Rumex acetosa*, *Cirsium palustre* and *Myosotis scorpioides*. Small stands of *Chamerion angustifolium* are occasionally scattered within the community.
- 5.7.4 The MG9 vegetation within the study area appears to be subject to a moderate level of grazing which evidently maintains a relatively open sward.

MG10 *Holcus lanatus* – *Juncus effusus* rush-pasture

Sub-communities recorded: MG10a

GWDTE Status – Moderate; CNPA – Wet grasslands

- 5.7.5 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 soil levels.
- 5.7.6 MG10 is characterised by an assemblage in which tussocks of *Juncus effusus* are present in species-poor swards of *Holcus lanatus*, *Agrostis stolonifera*, *Poa trivialis* and forbs including *Ranunculus acris*, *R. repens*, *Cardamine pratensis* and *Trifolium repens*. Mosses such as *Brachythecium rutabulum*, *Calliergonella cuspidata*, *Kindbergia praelonga* and *Rhytidiadelphus squarrosus* often form diffuse wefts over the damp soil and among the larger plants.
- 5.7.7 All of the MG10 vegetation mapped within the study area is referable to the **MG10a Typical sub-community**. This reflects both the species-poor nature of the vegetation as well as absence of the species characteristic of the other sub-communities (i.e. no *Juncus inflexus* or *Iris pseudacorus*). Among the *J. effusus* tussocks *H. lanatus* is invariably abundant, growing with frequent to occasional tussocks of *Deschampsia cespitosa* and the typical species already listed for the community as a whole. Locally, in addition to these, there may be occasional to rare *Rumex acetosa*, *R. obtusifolius*, *Hydrocotyle vulgaris*, *Cirsium palustre* and *Epilobium palustre*. Otherwise, the sward is generally species-poor and uneven.
- 5.7.8 The broad floodplain of the River Truim and other larger watercourses provide suitable habitat for the MG10a sub-community. Here it is present as moderately extensive areas in damp situations associated with palaeochannels or where a limited degree of water ponding occurs behind palaeoterraces. In these situations it is associated with other forms of grassland (especially U4) and rush-dominated mires (M6 and M23). MG10 is subject to grazing impacts by domestic stock, due to its location within the floodplain, and mosaics with grasslands used as

pasture. The soft ground conditions mean that MG10 is sensitive to the effects of poaching, especially where cattle are present. This often serves to break up the grass sward, thereby increasing the micro-topographic diversity, the species richness and the cover of the smaller plant associates.

5.8 Woodlands and Scrub

- 5.8.1 Semi-natural woodland and scrub communities are very limited within the study area, and many of the stands recorded are small and atypical for the assigned NVC communities or sub-communities, as further described below.

W11 Quercus petraea – Betula pubescens – Oxalis acetosella woodland

Communities/sub-communities recorded: W11, W11c

SBL – Upland birchwoods; CNPA – Birch and aspen woodland

- 5.8.2 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 heavily influenced by grazing (Rodwell *et al* 1991; Hall *et al* 2004).
- 5.8.3 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 described below, 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*.
- 5.8.4 Where no W11 sub-community has been allocated, the vegetation composition is generally a canopy of *Betula* spp. over a semi-improved grassy field layer similar to U4a or U4b grasslands. These woodlands have evidently been subject to grazing over an extended period of time, under a relatively open canopy. In some locations they may represent the establishment of a birch canopy within an area that was formerly open, acid grassland. These stands of ‘acid grassland with a birch canopy’ do not fit well into the W11 sub-communities. They are generally located within areas otherwise used for pasture (i.e. among or adjacent to areas of U4 in particular). Stands of *Pteridium aquilinum* can dominate the field layer, and where especially dense, they can completely suppress it beneath an accumulation of *P. aquilinum* leaf litter.
- 5.8.5 Most of this type of woodland within the study was classified to the W11 community level, but some woodland of the **W11c *Anemone nemorosa* sub-community** was also recorded. The W11c sub-community is distinguished by the presence of a lawn of *Rhytidiadelphus triquetrus* with the herbs *Trientalis europaea*, *Luzula pilosa* and *Anemone nemorosa*.
- 5.8.6 Stands of W11c birch woodland are generally located on the embankments and steeper verges along the flanks of the A9. Here, the free-draining conditions result in the abundance or dominance of *R. triquetrus*; the herb species are very limited in their cover. *L. pilosa* is occasional but *T. europaea* and *A. nemorosa* are largely absent. *Agrostis capillaris*, *Anthoxanthum odoratum*, *Erica cinerea*, *Pteridium aquilinum*, *Viola riviniana*, *Potentilla erecta*, *Deschampsia flexuosa* and *Teucrium scorodonia* are occasional to locally frequent in the moss-rich ground

cover. *Hylocomium splendens*, *Pleurozium schreberi* and *Rhytidiadelphus squarrosus* are occasional in the moss layer, amongst the dominant lawns and mounds of *R. triquetrus*.

- 5.8.7 The low species richness combined with the unevenness and situation of these woodlands on the embankments of the A9 is indicative of their secondary origins. Their situation and low levels of productivity means that they are not subject to significant grazing, except where the grass sward approaches that of the woodlands classified as W11 with no sub-community defined.

W17 Quercus petraea – Betula pubescens – Dicranum majus woodland

Sub-communities recorded: W17d

SBL – Upland birchwoods; CNPA – Birch and aspen woodland

- 5.8.8 *W17 Quercus petraea – Betula pubescens – Dicranum majus woodland* is a community of very acid, often thin and fragmentary soils in the cool, wet north-west of Britain where there is a strong tendency for mor accumulation and where high rainfall leads to strong leaching (Rodwell *et al* 1991; Hall *et al* 2004). Local differences in climate and topography have a strong influence on the vegetation and frequently interact with grazing to determine the distinctive floristics of the sub-communities (Rodwell *et al* 1991). In this community *Quercus petraea* and/or *Betula pubescens* usually dominate although *B. pubescens* is particularly frequent to the north-west where *Quercus* spp. are scarce. The field layer is usually characterised by ericoid shrubs, *Pteridium aquilinum* and grasses; bryophytes are also particularly abundant within this community (Rodwell *et al* 1991; Hall *et al* 2004).
- 5.8.9 Two small polygons with stands of W17 woodland were recorded within the study area, and were primarily referable to the **W17d *Rhytidiadelphus triquetrus* sub-community**. The dominance of *R. triquetrus* readily identified the W17d sub-community, with vascular plants in a subordinate role.
- 5.8.10 *Quercus* spp. are only very rarely present within the canopy within the Project 8 study area. *Betula* spp. are therefore dominant within the canopy but there are small areas where *Salix cinerea* is frequent. *Pinus sylvestris* and *Sorbus aucuparia* are occasional throughout. *Acer pseudoplatanus* can also be occasional, being of planted origin in small coupes.
- 5.8.11 *Rhytidiadelphus triquetrus* is dominant to abundant in the W17d ground layer, almost exclusively so over large areas. However, there are a relatively large number of associates although their cover is low and none are more than locally frequent. They include *Veronica chamaedrys*, *Myosotis arvensis*, *Luzula pilosa*, *Galium saxatile*, *Viola riviniana*, *Calluna vulgaris*, *Festuca rubra*, *F. ovina*, *Anthoxanthum odoratum*, *Deschampsia flexuosa* and *Holcus lanatus*. The mosses *Dicranum majus*, *Hylocomium splendens*, *Pleurozium schreberi* and *Rhytidiadelphus squarrosus* are occasional amongst the mounds and lawns of *R. triquetrus*.
- 5.8.12 Much of this W17 woodland is established on steep slopes associated with the banking of the A9. It is therefore evidently secondary in origin along much of its length and the age and spatial structure of the trees suggests that they are self-sown, rather than planted.

W18 *Pinus sylvestris* – *Hylocomium splendens* woodland

Communities recorded: W18

- 5.8.13 W18 *Pinus sylvestris* – *Hylocomium splendens* woodland is a community of strongly leached, lime-free, podzolic soils in the central and north-western highlands of Scotland. Variation in composition is generally related to the density and age of the pine canopy, but climate, soils and the incidence of browsing, grazing and burning are also important. *P. sylvestris* is always the most abundant tree, though *Betula* spp. may be common. There is a heathy field layer and bryophytes are dominant (Rodwell *et al* 1991; Hall *et al* 2004).
- 5.8.14 The stands of this community within the study area are either associated with dwellings, shelter-belts or with the embankments of the A9. As such, they are generally secondary stands and located on the lower ground, usually on the edge of the floodplain and in the vicinity of the A9.
- 5.8.15 The canopy is typically and diagnostically dominated by *P. sylvestris* although there is a little *Betula* spp., *Salix cinerea* and *Sorbus aucuparia* forming an understorey more commonly than joining the pines in the tall canopy. The field layer is locally dominated by *Hylocomium splendens* and *Deschampsia flexuosa* in a species-poor assemblage that also includes occasional *Erica cinerea*, *Dicranum majus*, *Pleurozium schreberi*, *Pseudoscleropodium purum* and *Rhytidiadelphus triquetrus*.
- 5.8.16 The prominence of mosses and the general absence of dwarf shrubs within the field layer, other than occasional shrubs of *E. cinerea*, is more indicative of the W18a *Erica cinerea* - *Goodyera repens* sub-community. However, the more distinctive species within this sub-community, such as *G. repens* were never recorded, confirming further the largely secondary nature of these woodlands.
- 5.8.17 On the embankments of the A9 there is evidently no management of the W18 woodlands, and grazing of the limited vascular plant growth appears to be very light at most. Where *P. sylvestris* have been planted around dwellings or farm units there can be some intrusion of *Urtica dioica* or *Cirsium arvense* marking the presence of sheltering livestock.

W23 *Ulex europaeus* – *Rubus fruticosus* scrub

Communities recorded: W23

- 5.8.18 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 lower altitudes. The vegetation often develops after woodland clearance of, or on, abandoned pasture (Rodwell *et al* 1991; Averis *et al* 2004).
- 5.8.19 Within the study area this community is indicated where *U. europaeus* and/or *Cytisus scoparius* form a relatively continuous canopy that may be open in places in a complex mosaic over the underlying vegetation. The underlying field layer is generally heathy (equating to H12), grassy (approximating to U4) or lacking vegetation because of the dense shade and litter accumulations from the canopy.
- 5.8.20 Various mixtures of *C. scoparius* and *U. europaeus* form the canopy where this community is mapped within the study area. The underlying field layer is usually heathy where the canopy is more open and the bushes scattered; otherwise there is a U4-type grassy ground flora equating to U4a or U4b depending upon the intensity of grazing, or an absence of vegetation beneath the densest areas of canopy. *Rubus fruticosus*, and more locally *R. idaeus*, can be occasional and are

distinctive associates, especially in comparison to the surrounding habitats where these species are scarce. The grazing and sheltering of animals results in the frequent appearance of *Urtica dioica* and *Cirsium arvense*.

- 5.8.21 The variation in the grassland associated with the scrub is indicative of the W23a and W23b sub-communities, with the former equating to 'heathy' U4a and the latter to a more improved, U4b-like sward. Very rarely, small stands of *Teucrium scorodonia* indicate the localised presence of elements of W23c. These sub-communities are not mapped separately because of the lack of clear distinction in the field, the small or narrowly linear areas involved and their limited value to nature conservation.
- 5.8.22 No management of the W23 scrub is evident but it often forms a locus for grazing animals because it occurs within or close to relatively productive/fertile areas and provides shelter.

5.9 Swamps and Tall-Herb Fens

S9 *Carex rostrata* swamp

Communities/sub-communities recorded: S9, S9a

SBL – Upland flushes, fens and swamps; CNPA – Wetlands

- 5.9.2 S9 swamp is generally a community of the north and west. The vegetation is typically a swamp of shallow to moderately deep, mesotrophic to oligotrophic standing waters with organic substrates. It also occurs more fragmentarily in peat cuttings (Rodwell *et al* 1995).
- 5.9.3 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.
- 5.9.4 The dominance of *C. rostrata* and absence or extremely low cover and number of associates make the **S9a *Carex rostrata* sub-community** an easy sub-community to identify. The only associate that appears to be consistent and at most frequent between and within stands within the study area and around the floodplain is *Potentilla palustris*. The larger stands of this community are mostly in the floodplain of the River Truim, where surface water collects. However, S9 was also frequently recorded in small to moderately sized stands in depressions on gentler slopes above and to the east of the A9.
- 5.9.5 No evident management effects are apparent in any of the locations from which S9 was recorded.

S19 *Eleocharis palustris* swamp

Communities/sub-communities recorded: S19, S19a

SBL – Upland flushes, fens and swamps; CNPA – Wetlands

- 5.9.6 S19 is a swamp of standing or running waters up to 50 cm deep, occurring around large lakes and small ponds, and along stream margins (Rodwell *et al* 1995). S19 is easily identified by the dominance of *Eleocharis palustris* rooted in shallow water.

- 5.9.7 This community was only recorded twice as two small areas within the study area, generally taking the form of the **S19a *Eleocharis palustris* sub-community** due to the sole dominance of *E. palustris* and the absence of any associates. This sub-community is confined here to marginal areas of open water, and is very limited in its total cover within the study area.

5.10 Vegetation of Open Habitats

OV27 *Chamerion angustifolium* community

- 5.10.2 OV27 *Chamerion angustifolium* tall-herb vegetation is a community that generally occurs on damp, fertile disturbed soils in woodlands, on heaths and along road verges and railway embankments; it is also commonplace in regenerating conifer plantation clear-fell areas. The OV27 community is marked by the dominant tall growth of *C. angustifolium*.
- 5.10.3 Within the study area such stands of *C. angustifolium* are frequent in close proximity to the A9 and subsidiary roads, and along railway embankments. Patches of OV27 occur in association with a variety of other vegetation types but especially grassland and heath. They are only rarely under trees. No distinctive associates are present because the tall growth of the *C. angustifolium* suppresses the underlying vegetation. Such stands are therefore mapped at the level of the community.

5.11 Non-NVC Communities & Categories

- 5.11.1 A number of non-NVC vegetation types or features were mapped during the survey. These were classified as follows. Codes used in the results are given in parentheses:
- Conifer plantation (CP)
 - Broadleaved plantation (BP)
 - Planted woodland, mixed (PW)
 - Bare ground (BG)
 - Disturbed ground (DG)
 - Buildings and associated driveways and private gardens (BD)
 - Inland cliffs or scree slopes (IC)
 - Scattered wood/scrub/shrubs (SWS)
 - Running water (RW)
 - Standing water (SW)
- 5.11.2 The plantation areas were unremarkable in terms of their flora and species composition. In more mature conifer plantations in particular there was often no ground flora found except some scattered mosses, the ground instead being blanketed in woody debris and needles. Younger plantations generally had a grassy understorey, most often resembling that of the U4 grassland community. These woodland plantation areas, along with areas of bare ground, disturbed ground, and building and associated gardens were floristically impoverished and of negligible

botanical importance. A few small scree slopes or areas of bare rock were recorded, but these also contained little if any vegetation.

- 5.11.3 Occasionally there are small areas of scattered trees (such as young *Betula* spp. and *Salix* spp.) and shrubs that together did not align to any NVC community. For example, these areas often accounted for small scrub invasion and encroachment into areas of heath. All of the non-NVC types recorded in the study area were of minor botanical importance and are therefore not discussed further within this report.

6 Evaluation of Botanical Interest

6.1 Overview

6.1.1 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 four classifications:

- SEPA guidance on GWDTE
- Habitats Directive (92/43/EEC) Annex I habitats
- Scottish Biodiversity List (SBL) priority habitats
- Cairngorms National Park Authority (CNPA) priority habitats

A summary table of all NVC communities recorded and any respective sensitivity is then detailed.

6.2 Groundwater Dependent Terrestrial Ecosystems (GWDTE)

6.2.1 SEPA has classified a number of NVC communities as potentially dependent on groundwater (SEPA, 2014a, 2014b). 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. Using SEPA's (2014a, 2014b) guidance, **Table 6.2.1** shows which NVC 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 6.1.1: NVC communities within the study area which, depending on hydrogeological setting, may potentially be classified as GWDTE (yellow = moderately groundwater dependent and red = highly groundwater dependent)

NVC Code	NVC Community Name
M15	<i>Trichophorum germanicum</i> – <i>Erica tetralix</i> wet heath
M25	<i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire
U6	<i>Juncus squarrosus</i> – <i>Festuca ovina</i> grassland
MG9	<i>Holcus lanatus</i> – <i>Deschampsia cespitosa</i> grassland
MG10	<i>Holcus lanatus</i> – <i>Juncus effusus</i> rush pasture
M6	<i>Carex echinata</i> – <i>Sphagnum fallax/denticulatum</i> mire
M10	<i>Carex dioica</i> - <i>Pinguicula vulgaris</i> mire
M11	<i>Carex demissa</i> – <i>Saxifraga aizoides</i> mire
M16	<i>Erica tetralix</i> – <i>Sphagnum compactum</i> wet heath
M23	<i>Juncus effusus/acutiflorus</i> – <i>Galium palustre</i> rush pasture
M32	<i>Philonotis fontana</i> – <i>Saxifraga stellaris</i> spring
M37	<i>Palustriella commutata</i> – <i>Festuca rubra</i> spring

- 6.2.2 The location and extent of all identified potential GWDTE are provided on an appropriate NVC map see **Figure 6.1**.
- 6.2.3 Within **Figure 6.1** 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.
- 6.2.4 GWDTE sensitivity has been assigned solely on the SEPA listings (SEPA, 2004a, 2014b). 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 will require further assessment.

6.3 Annex I Habitats

Overview

- 6.3.2 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.
- 6.3.3 Using Joint Nature Conservation Committee (JNCC) Annex I habitat listings and descriptions¹, which have then been compared with survey results and field observations, the following NVC communities within the study area which may constitute Annex I habitat are shown in **Table 6.3.1**. The locations of these Annex I habitat types are also shown within **Figure 6.2**. Within **Figure 6.2**, all polygons which contain an Annex I habitat type are shaded, irrespective of the percentage cover of Annex I habitat within that polygon. Each polygon is shaded according to the

¹ <http://jncc.defra.gov.uk/page-1523>

dominant Annex I type within the polygon; however, many polygons contain multiple Annex I habitat types, therefore the communities listed should be cross-referenced to **Table 6.3.1**.

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

Table 6.2.1: NVC communities within the study area and corresponding Annex I habitat types

NVC Code	NVC Community Name	Annex I Code	Annex I Title
M1	<i>Sphagnum denticulatum</i> bog pool community	7130	Blanket bog
M3	<i>Eriophorum angustifolium</i> bog pool community	7130	Blanket bog
M4	<i>Carex rostrata</i> - <i>Sphagnum fallax</i> mire	7140	Transition mires and quaking bogs
M10, M10a	<i>Carex dioica</i> - <i>Pinguicula vulgaris</i> mire	7230	Alkaline fens
M15, M15a, M15b, M15c, M15d	<i>Trichophorum germanicum</i> – <i>Erica tetralix</i> wet heath	4010, or 7130	Northern Atlantic wet heaths with <i>Erica tetralix</i> , or blanket bog where peat depth is greater than 0.5 m
M16, M16d	<i>Erica tetralix</i> – <i>Sphagnum compactum</i> wet heath	4010, or 7130	Northern Atlantic wet heaths with <i>Erica tetralix</i> , or blanket bog where peat depth is greater than 0.5 m
M17, M17a	<i>Trichophorum germanicum</i> – <i>Eriophorum vaginatum</i> blanket mire	7130	Blanket bog
M19, M19a	<i>Calluna vulgaris</i> - <i>Eriophorum vaginatum</i> blanket mire	7130	Blanket bog
M25, M25a	<i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire	7130	Blanket bog, where peat depth is greater than 0.5 m
M37	<i>Palustriella commutata</i> – <i>Festuca rubra</i> spring	7220	Petrifying springs with tufa formation (<i>Cratoneuron</i>)
H10, H10c	<i>Calluna vulgaris</i> - <i>Erica cinerea</i> heath	4030	European dry heaths
H12, H12a, H12c	<i>Calluna vulgaris</i> - <i>Vaccinium myrtillus</i> heath	4030	European dry heaths
H16, H16a, H16b	<i>Calluna vulgaris</i> - <i>Arctostaphylos uva-ursi</i> heath	4030	European dry heaths
H18	<i>Vaccinium myrtillus</i> – <i>Deschampsia flexuosa</i> heath	4030	European dry heaths
H21a	<i>Calluna vulgaris</i> – <i>Vaccinium myrtillus</i> – <i>Sphagnum capillifolium</i> heath	4030	European dry heaths
U5c	U5c <i>Nardus stricta</i> – <i>Galium saxatile</i> grassland <i>Carex panicea</i> - <i>Viola riviniana</i> sub-community	6230	Species-rich <i>Nardus</i> grassland, on siliceous substrates in mountain areas (and submountain areas in continental Europe) (U5c only)

7130 Blanket bog

6.3.5 Annex I type 7130 blanket bog correlates directly with a number of NVC communities within the study area such as the M17 and M19 mires. However, 7130 blanket bog can also include the bog pool communities where these are located within the wider blanket mires (such as M17/M19). As such the M1 and M3 communities within the study area have also been assigned to the blanket

bog Annex I type, as they were often associated with areas of M17 and M19 mire. The areas where M2 was mapped were not in association with bog habitats and have therefore not been included within the Annex I classification in **Table 6.3.1**.

- 6.3.6 M25 mire and M15² and M16 wet heaths can also fall within the 7130 blanket bog Annex I type where the peat depth underlying these communities is greater than 0.5 m. In the absence of detailed peat depth data for areas of M25 mire, these have also been classified as potential Annex I blanket bog, to represent a worst case scenario.
- 6.3.7 M15 and M16 also fall under the 4010 Northern Atlantic wet heaths with *Erica tetralix* Annex I type, and therefore do not need blanket bog status to be recognised as of conservation interest.

7140 Transition mires and quaking bogs

- 6.3.8 All examples of the M4 *Carex rostrata* - *Sphagnum fallax* mire community 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 transitional between acid bog and alkaline fens.

4010 Northern Atlantic wet heaths with *Erica tetralix*

- 6.3.9 All examples of M15 and M16 wet heaths were included within the 4010 Northern Atlantic wet heaths category. However, as per section 6.3.2 above, in areas where peat depth is greater than 0.5 m these areas could also feasibly fall within the 7130 blanket bog classification.

7230 Alkaline fens

- 6.3.10 Alkaline fens consist of a complex assemblage of vegetation types characteristic of sites where there is tufa and/or peat formation with a high water table and a calcareous base-rich water supply. The core vegetation is short sedge mire. All examples of M10 mire in the study area fall within this Annex I habitat type.

7240 Alpine pioneer formations of the *Caricion bicoloris-atrofuscae*

- 6.3.11 Alpine pioneer formations of the *Caricion bicoloris-atrofuscae* is a type of flush mire that occurs only at high altitude. The characteristic plant communities colonise open substrates that are constantly flushed by surface seepage of cold, base-rich water. The vegetation consists of mixtures of small sedges, rushes, small herbs and bryophytes, and includes many arctic-alpine species. High-altitude stands only, of four NVC types enriched by arctic-alpine elements, fall within the definition of this Annex 1 habitat type: these NVC types include M10 and M11.

² Excluding the M15a *Carex panicea* sub-community, due to its general flushed nature over shallower substrates.

- 6.3.12 M10 and M11 flushes were recorded within the study area. M10 flushes are included within the 7230 alkaline fen Annex I type. The M11 flushes within the study area have not been assigned to the 7240 alpine pioneer formations Annex I type because they belong to the M11b sub-community; Annex 1 type 7240 includes the other sub-community (M11a, which is of a more montane nature), but not M11b.

7220 Petrifying springs with tufa formation (*Cratoneuron*)

- 6.3.13 Tufa formation is associated with hard-water springs, where groundwater rich in calcium bicarbonate comes to the surface. These conditions occur most often in areas underlain by limestone or other calcareous rocks, and particularly in the uplands of northern England and the Scottish Highlands. All examples of the M37 *Palustriella commutata* – *Festuca rubra* spring in the study area fall within this Annex I type.

4030 European dry heaths

- 6.3.14 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 is heather *Calluna vulgaris*.
- 6.3.15 All dry heath in the study area is semi-natural and evidently derived from woodland or scrub through a long history of grazing and burning. The five dry heath communities recorded - H10, H12, H16, H18 and H21 – 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.
- 6.3.16 The most common form of dry heath in the study area is H12. However, as noted in section 5.4.2, the most common form of H12 here is a low quality form of the H12a *Calluna vulgaris* sub-community which consists of little more than *C. vulgaris* over a lawn of pleurocarpous mosses.

6230 Species-rich *Nardus* grassland, on siliceous substrates in mountain areas

- 6.3.17 Species-rich *Nardus* grasslands on siliceous substrates in mountain areas (and submountain areas in continental Europe) tend to develop where there is flushing through base-rich strata on siliceous bedrock. These may include moderately base-rich metamorphic and igneous rocks. Species-rich *Nardus* grasslands on limestone are excluded from the definition of this Annex I habitat because limestone lacks silica. Two main types of species-rich *Nardus* grasslands occur in the UK: CG10 *Festuca ovina* – *Agrostis capillaris* – *Thymus polytrichus* grassland and CG11 *Festuca ovina* – *Agrostis capillaris* – *Alchemilla alpina* grassland. However, the base-enriched U5c *Nardus stricta* – *Galium saxatile* grassland *Carex panicea*-*Viola riviniana* sub-community can also fall within this Annex I type, and this is the NVC type within the study area which accounts for this Annex I type. Two very small areas of U5c were recorded during the survey (see section 5.6.4).

91C0 Caledonian forest

- 6.3.18 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.
- 6.3.19 The only record of W18 in the study area is a very small patch of youngish trees in a narrow area between the A889 and the River Truim, a short distance west of the A9/A889 junction south of

Dalwhinnie. This appears to be secondary woodland which might have colonized the river-road zone since the A9/A889 junction was built. Therefore it has not been deemed a candidate area for Annex I H91C0 Caledonian forest status.

91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles

- 6.3.20 This habitat type comprises a range of woodland types dominated by mixtures of *Quercus* spp. and *Betula* spp. It is characteristic of base-poor soils in areas of at least moderately high rainfall in northern and western parts of the UK. The habitat corresponds particularly to NVC types W10e, W11, W16b and W17.
- 6.3.21 Relatively small areas of W11 and W17 were recorded within the study area, but they were not deemed to be of Annex I status because (a) they are birchwoods with little or no oak, and (b) they appear to be largely secondary in nature, being stands flanking embankments of the existing A9. It is therefore neither appropriate nor correct to refer to them as ‘old sessile oak woods’.

6.4 Scottish Biodiversity List Priority Habitats

- 6.4.1 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.
- 6.4.2 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.
- 6.4.3 The relevant SBL priority habitat types (full descriptions of which can be found on the Biodiversity Scotland website³), and associated NVC types recorded within the study area are as follows:
- **Blanket bog:** M17, M19, M1 and M3 (these last two where associated with M17/M19), and M15⁴/M16/M25 where peat depth is greater than 0.5 m
 - **Upland flushes, fens and swamps:** M4, M6, M10, M11, M23 (sub-community M23a only), M32, M37, S9, S19
 - **Upland heathland:** M15, M16, H10, H12, H16, H18, H21
 - **Upland calcareous grassland:** U5c only
 - **Upland birchwoods:** W11, W17
- 6.4.4 These SBL priority habitats correspond with UK Biodiversity Action Plan (BAP) Priority Habitats⁵

³ <http://www.biodiversityscotland.gov.uk/advice-and-resources/habitat-definitions/priority/>

⁴ Excluding the M15a *Carex panicea* sub-community, due to its general flushed nature over shallower substrates.

6.4.5 This information is also summarised in **Table 6.6.1** below. The locations of these SBL priority habitats are also shown within **Figure 6.3**. Within **Figure 6.3**, all polygons which contain a SBL priority habitat type are shaded, irrespective of the percentage cover of SBL priority habitat within that polygon. Each polygon is shaded according to the dominant SBL priority habitat type within the polygon; however, many polygons contain multiple SBL priority habitat types, therefore the communities listed should be cross-referenced to **Table 6.6.1**.

6.5 Cairngorms National Park Authority Priority Habitats

6.5.1 The CNPA also identifies a number of priority habitats within its Cairngorms Nature Action Plan 2013-2018. The aims of the plan reflect the consultation on and commitment to the National Park Partnership Plan 2012-2017 and the need for action on threatened and endangered habitats and species. The CNPA priority habitats are broad and encompass many possible NVC communities. They do however align closely with the SBL and UK BAP priority habitats.

6.5.2 The relevant CNPA priority habitat types, and associated NVC types, recorded within the study area were as follows:

- **Blanket bog:** M17, M19, M1 and M3 (these last two where associated with M17/M19)
- **Wetlands⁶:** M4, M6, M10, M11, M23a, M32, M37, S9, S19
- **Wet grasslands:** M23b, MG9, MG10
- **Upland heathland:** M15, M16, H10, H12, H16, H18, H21
- **Grasslands:** U5c only
- **Birch and aspen woodland:** W11, W17

6.5.3 This information is also summarised in **Table 6.6.1** below. The locations of these CNPA priority habitats are also shown within **Figure 6.4**. Within **Figure 6.4**, all polygons which contain a CNPA priority habitat type are shaded, irrespective of the percentage cover of CNPA priority habitat within that polygon. Each polygon is shaded according to the dominant CNPA priority habitat type within the polygon; however, many polygons contain multiple CNPA priority habitat types, therefore the communities listed should be cross-referenced to **Table 6.6.1**.

⁵ <http://jncc.defra.gov.uk/page-5718>

⁶ Many of these communities are included within the wetlands CNPA priority habitat on the assumption that their 'wetlands' category includes SBL and UKBAP priority habitat type upland flushes, fens & swamps.

6.6 Summary

6.6.1 **Table 6.6.1** provides a summary of all the NVC communities recorded within the study area, and any associated habitat sensitivities as described above.

Table 6.6.1: Summary of study area NVC communities and associated sensitivities

NVC Codes Recorded	Potential GWDTE Status	Annex I Type Code	SBL Priority Habitat Type	CNPA Priority Habitat Type
Mires and Wet Heath				
M1		7130 – Blanket bogs	Blanket bog	Blanket bog
M2				
M3		7130 – Blanket bogs	Blanket bog	Blanket bog
M4		7140 – Transition mires and quaking bogs	Upland flushes, fens and swamps	Wetlands
M6, M6a, M6b, M6c, M6d	High		Upland flushes, fens and swamps	Wetlands
M10, M10a	High	7230 – Alkaline fens	Upland flushes, fens and swamps	Wetlands
M11b	High		Upland flushes, fens and swamps	Wetlands
M15, M15a, M15b, M15c, M15d	Moderate	4010 – Northern Atlantic wet heaths with <i>Erica tetralix</i> or 7130 – Blanket bogs (where peat is greater than 0.5 m deep) (*M15a excluded from blanket bog)	Upland heathland or blanket bogs (where peat is greater than 0.5 m deep) (*M15a excluded from blanket bog)	Upland heathland
M16, M16d	High	4010 – Northern Atlantic wet heaths with <i>Erica tetralix</i> or 7130 – Blanket bogs (where peat is greater than 0.5 m deep)	Upland heathland or blanket bogs (where peat is greater than 0.5 m deep)	Upland heathland
M17, M17a		7130 – Blanket bogs	Blanket bog	Blanket bog
M19, M19a		7130 – Blanket bogs	Blanket bog	Blanket bog
M23a, M23b	High		Upland flushes, fens and swamps (applies to M23a only)	Wetlands (M23a); Wet grasslands (M23b)
M25, M25a	Moderate	7130 – Blanket bogs (where peat is greater than 0.5 m deep)	Blanket bog (where peat is greater than 0.5 m deep)	
M32, M32a	High		Upland flushes, fens and swamps	Wetlands
M37	High		Upland flushes, fens and swamps	Wetlands

NVC Codes Recorded	Potential GWDTE Status	Annex I Type Code	SBL Priority Habitat Type	CNPA Priority Habitat Type
Dry Heaths				
H10, H10c		4030 – European dry heaths	Upland heathland	Upland heathland
H12, H12a, H12c		4030 – European dry heaths	Upland heathland	Upland heathland
H16, H16a, H16b		4030 – European dry heaths	Upland heathland	Upland heathland
H18		4030 – European dry heaths	Upland heathland	Upland heathland
H21a		4030 – European dry heaths	Upland heathland	Upland heathland
Calcifugous Grasslands				
U1e				
U2b				
U4, U4a, U4b				
U5, U5a, U5b, U5c		6230 Species-rich <i>Nardus</i> grassland on siliceous substrates in mountain areas (and submountain areas in continental Europe) (*U5c only)	Upland calcareous grassland (*U5c only)	Grasslands (*U5c only)
U6	Moderate			
U20a				
Mesotrophic grasslands				
MG9a	Moderate			Wet grasslands
MG10a	Moderate			Wet grasslands
Woodland and Scrub				
W11, W11c			Upland birchwoods	Birch and aspen woodland
W17d			Upland birchwoods	Birch and aspen woodland
W18				
W23				
Swamps and Tall-Herb Fens				
S9, S9a			Upland flushes, fens and swamps	Wetlands
S19, S19a			Upland flushes, fens and swamps	Wetlands
Vegetation of Open Habitats				
OV27				

7 Future Survey Requirements

7.1.1 The NVC surveys and associated results have highlighted areas where further survey work and assessment may be required or beneficial.

7.2 GWDTE

7.2.1 As discussed in section 6.2 above, the NVC results have been compared with guidance on GWDTE provided by SEPA. The guidance provides only a list of ‘potentially’ moderately and highly sensitive GWDTE in relation to NVC communities. To determine if certain areas or habitats are actually influenced by groundwater will require further assessment and survey if considered necessary. To reduce the amount of assessment and survey effort required over such a large area, it is suggested that further work on GWDTE is undertaken once a preferred dualling route option is known.

7.3 Peat Depth

7.3.1 As baseline surveys and ground investigation progresses there is a growing peat depth data set for parts of the study area. This data, in association with the NVC results and more targeted peat depth surveys of certain areas, may be useful in reclassification of some receptor areas as less sensitive. For example, M25 mire is generally a poor habitat, but it can fall within both the Annex I and SBL categories of blanket bog where peat is deeper than 0.5 m. In the absence of peat depth data all M25 within the sensitivity table and associated polygons and figures is treated as potential blanket bog, but if it can be shown that the peat depth in any of these areas is less than 0.5 m then those areas of M25 can be downgraded from being a blanket bog receptor. This may well indeed be the case as many areas of M25 are associated (in mosaic polygons) with grassland/heath habitats.

8 Summary

- 8.1.1 MacArthur Green carried out NVC surveys within the Project 8 study area from 29th of June 2015 to 3rd of July 2015 inclusive. The aim of the NVC surveys was to identify and map the vegetation communities present in order to identify those areas of greatest ecological interest: i.e. potential GWDTE, Annex I habitats, SBL priority habitats, and CNPA priority habitats.
- 8.1.2 The NVC surveys revealed the presence of a wide range of habitat types – mainly mires, heaths and grasslands - culminating in 35 community types within the study area, along with a wide range of further sub-communities. Several non-NVC types were also recorded.
- 8.1.3 This report has described in more detail these vegetation communities as found in the study area. The survey results have also been compared to a number of sensitivity classifications, indicating the presence of Annex I, SBL and CNPA priority habitats and potential GWDTE habitats, as summarised in **Table 6.6.1**.

9 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.

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).

humic rankers: shallow soils with an organic-rich (humose) surface layer overlying a weakly developed, thin subsoil on to rock.

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.

palaeochannel: a remnant of an inactive river or stream channel that has been either filled or buried by younger sediment. The sediments that the ancient channel is either cut into or buried by can be either unconsolidated, semi-consolidated, consolidated, or lithified.

plagioclimax community: an area or habitat in which anthropogenic influences have prevented the habitat/ecosystem developing further. It may have been prevented from reaching its full climatic climax or shifted towards a different climax type by activities such as burning, grazing, vegetation clearance etc.

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).

tufa: a variety of limestone, formed by the precipitation of calcium carbonate deposited by springs.

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Appendix A

NVC Target Notes

11 NVC Target Notes

11.1.1 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 5.2** and detailed within **Table 11.1.1** below. A representative sample of corresponding target note photographs is provided in Appendix B.

Table 11.1.1: Project 8 study area target notes

Target Note ID	Easting	Northing	NVC Community	Description	Photo reference
S1_1	263970	781605	M15a	M15a flush	B-1
S1_2	264116	781566	M15a	Number of M15a flushes in this area.	
S1_3	264127	781664	M15a	Flushing down slope, on peat, lots of <i>Myrica gale</i> and <i>Eriophorum angustifolium</i> in flush.	
S1_4	264138	781699	M15a	Contains some <i>Drosera rotundifolia</i> , <i>Pinguicula vulgaris</i> , <i>Carex</i> spp., <i>Trichophorum germanicum</i> , <i>Eriophorum angustifolium</i> , <i>Dactylorhiza maculata</i> .	B-2
S1_5	264023	781792	M15a	Flush	B-3
S1_6	264052	781953	M15a	Flush with <i>Trichophorum germanicum</i> , <i>Eriophorum angustifolium</i> , <i>Carex</i> spp., <i>Drosera rotundifolia</i> and <i>Pinguicula vulgaris</i> .	B-4
S1_7	264154	781958	M10	<i>Pinguicula vulgaris</i> and brown mosses common.	B-5
S1_8	264191	781967	M15a	M15a flushing with <i>Erica tetralix</i> , <i>Trichophorum germanicum</i> , <i>Eriophorum angustifolium</i> , <i>Carex panicea</i> , <i>C. viridula</i> , <i>Drosera rotundifolia</i> , <i>Pinguicula vulgaris</i> , <i>Sphagnum denticulatum</i> and brown mosses.	
S1_9	264191	782011	M15a	M15a flushing with <i>Erica tetralix</i> , <i>Trichophorum germanicum</i> , <i>Eriophorum angustifolium</i> , <i>Carex panicea</i> , <i>C. viridula</i> , <i>Drosera rotundifolia</i> , <i>Pinguicula vulgaris</i> , <i>Sphagnum denticulatum</i> and brown mosses.	
S1_10	264006	782009	M15a	Flush	
S1_11	264147	782188	M15a	Flush with <i>Trichophorum germanicum</i> , <i>Eriophorum angustifolium</i> , <i>Carex</i> spp., <i>Drosera rotundifolia</i> and <i>Pinguicula vulgaris</i> .	
S1_12	264341	782443	M15a	M15a flushing with typical species for this sub-community.	B-6
S1_13	264076	782481	M15a	Flush	
S1_14	264030	782483	M6	Contains <i>Eriophorum angustifolium</i> , <i>Molinia caerulea</i> , larger <i>Carex</i> spp., <i>Sphagnum</i> spp., and some <i>Menyanthes trifoliata</i> .	B-7
S1_15	264351	782507	M15a	M15a flushing with typical species for this sub-community.	
S1_16	264371	782567	M10	Typical open sward stony M10 flush feature, small sedge dominated.	

Target Note ID	Easting	Northing	NVC Community	Description	Photo reference
S1_17	264194	783154	M6c	Formed artificially from infilling and occlusion of old drainage channel. Non GWDTE. Typical species for sub-community present.	B-8
S1_18	264232	783226	M6	Flanking margins of minor watercourse.	
S1_19	264015	783267	M6	Contains <i>Juncus effusus</i> , <i>Agrostis</i> spp., <i>Luzula multiflora</i> , <i>Carex nigra</i> , <i>Sphagnum cuspidatum</i> , <i>Cirsium palustre</i> and <i>Aulacomnium palustre</i> .	
S2_1	264077	783395	M15a	Flush with <i>Carex</i> spp. and <i>Drosera rotundifolia</i> .	
S2_2	264156	783479	M15a	Bit more open sward and stony within line of old drainage channel, lots of small <i>Carex</i> spp., some <i>Trichophorum germanicum</i> , <i>Eriophorum angustifolium</i> and brown mosses.	
S3_1	264847	785660	M15a	<i>Eriophorum angustifolium</i> , <i>Pinguicula vulgaris</i> , <i>Drosera rotundifolia</i> , <i>Sphagnum</i> spp.	
S3_2	265051	785937	M15a	Couple of flushes in this area, muddy, some <i>Sphagnum</i> spp., <i>Myrica gale</i> , <i>Eriophorum angustifolium</i> , <i>Pinguicula vulgaris</i> , <i>Trichophorum germanicum</i> , <i>Erica tetralix</i> , small <i>Carex</i> spp.	B-9
S3_3	265195	785849	M15a	Few flushes in this area - <i>Myrica gale</i> , <i>Myrica gale</i> , <i>Drosera rotundifolia</i> , <i>Carex</i> spp.	
S3_4	265834	787256	M15a	Number of flushes in this area, lots of <i>Carex panicea</i> , <i>Trichophorum germanicum</i> , <i>Drosera rotundifolia</i> , <i>Sphagnum</i> spp., <i>Erica tetralix</i> , some <i>Myrica gale</i> , natural hollow line for water.	
S3_5	265922	787378	M15a	Number of flushes in this area, lots of <i>Carex panicea</i> , <i>Trichophorum germanicum</i> , <i>Drosera rotundifolia</i> , <i>Sphagnum</i> spp., <i>Erica tetralix</i> , some <i>Myrica gale</i> , natural hollow line for water.	B-10
S3_6	266408	787739	M15a	Flush	
S3_7	266659	787948	M32	M32 spring. Species present include <i>Philonotis fontana</i> , <i>Dichodontium palustre</i> , <i>Sphagnum denticulatum</i> and <i>Scapania undulata</i> . Occasional plants of other species including <i>Saxifraga stellaris</i> , <i>Viola palustris</i> , <i>Pinguicula vulgaris</i> , <i>Thalictrum alpinum</i> , <i>Montia fontana</i> , <i>Calluna vulgaris</i> and <i>Carex panicea</i> .	B-11
S3_8	266580	788152	M6a	Lots <i>Carex echinata</i> and <i>Sphagnum</i> spp., also <i>Eriophorum angustifolium</i> , flat, peaty area, within wider M15b.	B-12
S3_9	266614	788201	M15a	Small <i>Carex</i> spp. including <i>C. echinata</i> and <i>C. panicea</i> . <i>Sphagnum denticulatum</i> and brown mosses. Drainage line flush.	

Target Note ID	Easting	Northing	NVC Community	Description	Photo reference
S3_10	266781	788288	M10	M10 base-enriched flushes with species including <i>Carex panicea</i> , <i>C. hostiana</i> , <i>C. viridula</i> and the bryophytes <i>Campylium stellatum</i> , <i>Scorpidium scorpioides</i> , <i>S. revolvens</i> , <i>Breutelia chrysocoma</i> and <i>Sphagnum contortum</i> .	B-13
S3_11	266996	788287	M15a	Lots <i>Carex panicea</i> and <i>C. viridula</i> , <i>Erica tetralix</i> . No obvious groundwater sources.	B-14
S3_12	267238	788580	M10	A clear GWDTE - appears suddenly out of slope, lots <i>Pinguicula vulgaris</i> , brown mosses, <i>Trichophorum germanicum</i> , <i>Erica tetralix</i> , <i>Juncus squarrosus</i> , <i>Narthecium ossifragum</i> and <i>Eriophorum angustifolium</i> .	B-15
S3_13	267185	788764	M15a	Small <i>Carex</i> spp. dominate, only odd <i>Pinguicula vulgaris</i> , <i>Narthecium ossifragum</i> , <i>Sphagnum denticulatum</i> , <i>Eriophorum angustifolium</i> and <i>Drosera rotundifolia</i> .	
S3_14	267236	788852	M10	M10 flush with lots of small sedges.	B-16
S3_15	267401	788814	M10	M10 hillslope flushing.	
S3_16	267344	788893	M15a	Few M15a flushes, small <i>Carex</i> spp. and brown mosses.	
S4_1	267514	789270	n/a	<i>Thalictrum alpinum</i> and <i>Briza media</i> in M15a wet heath.	
S4_2	267497	789293	n/a	<i>Briza media</i> in M15a wet heath.	
S4_3	267707	789528	n/a	Rocky stream/gully with rich flora including <i>Populus tremula</i> , <i>Betula pubescens</i> , <i>Sorbus aucuparia</i> , <i>Salix aurita</i> , <i>S. caprea</i> , <i>Juniperus communis</i> , <i>Arctostaphylos uva-ursi</i> , <i>Alchemilla alpina</i> , <i>Geranium sylvaticum</i> , <i>Saxifraga aizoides</i> , <i>Galium boreale</i> and the bryophytes <i>Breutelia chrysocoma</i> , <i>Ditrichum gracile</i> , <i>Sphagnum teres</i> , <i>Douinia ovata</i> and <i>Gymnomitrium obtusum</i> .	B-17
S4_4	267921	789582	M6	<i>Eriophorum angustifolium</i> , <i>Erica tetralix</i> , occasional <i>Myrica gale</i> , <i>Calluna vulgaris</i> , and <i>Carex</i> spp.	
S4_5	267776	789755	M37	M37 spring dominated by <i>Palustriella commutata</i> mixed with smaller amounts of <i>Philonotis fontana</i> . Scattered very thinly among the extensive spongy carpets of these mosses are various vascular species: <i>Cirsium palustre</i> , <i>Carex flacca</i> , <i>Festuca rubra</i> , <i>Holcus lanatus</i> , <i>Equisetum palustre</i> and <i>Epilobium anagallidifolium</i> .	B-18
S4_6	268033	790272	M6	Some minor flushing.	
S4_7	268068	790384	M32	M32 spring with <i>Philonotis fontana</i> , <i>Dichodontium palustre</i> , <i>Viola palustris</i> and <i>Pinguicula vulgaris</i> .	B-19

Target Note ID	Easting	Northing	NVC Community	Description	Photo reference
TI_1	263832	780960	M15a	M15a flushing with <i>Erica tetralix</i> , <i>Trichophorum germanicum</i> , <i>Eriophorum angustifolium</i> , <i>Carex panicea</i> , <i>C. viridula</i> , <i>Drosera rotundifolia</i> , <i>Pinguicula vulgaris</i> , <i>Sphagnum denticulatum</i> and brown mosses. Water flowing in small drainage like feature.	
TI_2	263850	780966	M15a	Clusters of M15a flushes.	
TI_3	263854	780958	M15a	Cluster of M15a flushes interlocked, through heath.	
TI_4	263895	780993	M15a	Clusters of M15a flushes.	
TI_5	263968	781029	M15a	Clusters of M15a flushes.	
TI_6	264064	781073	M15a	Species-poor example.	
TI_7	263893	781313	M15a	Flush with <i>Trichophorum germanicum</i> , <i>Eriophorum angustifolium</i> , <i>Carex</i> spp., <i>Drosera rotundifolia</i> and <i>Pinguicula vulgaris</i> .	B-20
TI_8	264100	781471	M15a	Number of flushes in this area, lots of small <i>Carex</i> spp. and some <i>Pinguicula vulgaris</i> .	B-21
TI_9	263953	781520	M15a	Flush with frequent <i>Trichophorum germanicum</i> , <i>Eriophorum angustifolium</i> and <i>Carex viridula</i> .	

Appendix B

Target Note Photographs

12 Target Note Photographs

- 12.1.1 The following photographs correlate to the target notes described within Appendix 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.

Photograph B-1: Target note S1_1.

- 12.1.2 M15a flushing with many of the characteristic species.



Photograph B-2: Target note S1_4.

12.1.3 Number of M15a flushes.



Photograph B-3: Target note S1_4.

12.1.4 Runnel of M15a.



Photograph B-4: Target note S1_6.

12.1.5 M15a flushing with many small *Carex* spp. in foreground.



Photograph B-5: Target note S1_7.

12.1.6 Area with some M10 flushing, more stony with open sward.



Photograph B-6: Target note S1_12.

12.1.7 M15a flushing.



Photograph B-7: Target note S1_14.

12.1.8 Depression with M6 vegetation.



Photograph B-8: Target note S1_17.

12.1.9 M6c vegetation within occluded former drainage feature.



Photograph B-9: Target note S3_2.

12.1.10 Narrow hillslope M15a flushes with lots of *Carex* spp.



Photograph B-10: Target note S3_2.

12.1.11 Area with number of M15a flushes on hillslope.



Photograph B-11: Target note S3_7.

12.1.12 M32 spring community.



Photograph B-12: Target note S3_8.

12.1.13 M6a flush with lots of *Carex echinata* and *Sphagnum* spp. within wider M15b.



Photograph B-13: Target note S3_10.

12.1.14 M10 flushes.



Photograph B-14: Target note S3_11

- 12.1.15 M15a flushing, vegetation dominated by *Carex panicea*, with some *C. viridula* and *Erica tetralix*.



Photograph B-15: Target note S3_12.

- 12.1.16 M10 flush, originates from defined point source on slope, GWDTE.



Photograph B-16: Target note S3_14.

12.1.17 M10 flush.



Photograph B-17: Target note S4_3.

12.1.18 Rocky stream/gully with rich flora.



Photograph B-18: Target note S4_5.

12.1.19 M37 spring, dominated by *Palustriella commutata*.



Photograph B-19: Target note S4_7.

12.1.20 M32 spring community, a GWDTE.



Photograph B-20: Target note T1_7.

12.1.21 M15a flush.



Photograph B-21: Target note T1_8.

12.1.22 M15a flushing with abundant small *Carex* spp. and frequent *Pinguicula vulgaris*.



