

# Appendix 12.3

## Phase 2 Habitat Survey (NVC)

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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 was commissioned to assist CFJV with vegetation and habitat classification elements relating to the Design Manual for Roads and Bridges 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 7 (Glen Garry to Dalwhinnie) during 2015.

## 2 The Study Area

- 2.1.1 Project 7 extends from a short distance south of Dalwhinnie southwards to Glen Garry, by Dalnaspidal. 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 7; the River Truim to the west of the A9, and in the southern study area the Allt Dubhaig Burn, also to the west of A9. The study area was reduced accordingly in these areas. 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 7 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 7, the study area covered parts of the Drumochter Hills Site of Special Scientific Interest (SSSI) and SAC (Special Area of Conservation). The relevant qualifying features for each designation are detailed in **Table 2-1** below.

Table 2-1: Designated sites with botanical qualifying features that overlap with the Project 7 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 necessarily need to record quadrats in order to reliably identify NVC communities and sub-communities (Rodwell, 2006). Notes were made about the structure and flora of larger areas of vegetation in many places (such as the abundance and frequency of species, and in some cases condition and evident anthropogenic impacts). It can be better to record several larger scale qualitative samples than one or two smaller quantitative samples; furthermore, qualitative information from several sample locations can be vital for understanding the dynamics and trends in local (study area) vegetation patterns (Rodwell, 2006).
- 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.

### 3.2 Survey Constraints and Limitations

- 3.2.1 The NVC survey for Project 7 was carried out from 20 July 2015 to 23 July 2015 inclusive, during the optimal season for habitat surveys. Surveys were carried out by three surveyors, over 12 surveyor days, approximately between the hours of 08:30 – 18:30. The weather conditions were amenable to survey; bright, with broken cloud and relatively light to moderate winds, and with infrequent light showers. All parts of the study area were accessible and as such there were no constraints on the survey.
- 3.2.2 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 additional communities being

described that do not fall within the NVC system. Where such communities are found and recorded they are given a non-NVC community code and are described.

- 3.2.3 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.

## 4 NVC Survey Results and Vegetation

### Descriptions

#### 4.1 Summary of NVC Communities

4.1.1 The categories of vegetation within the study area include the following 40 NVC communities recorded during the survey:

- Mires, flushes and springs: M1, M2, M3, M4, M5, M6, M10, M11, M17, M19, M20, M23, M25, M29, M32
- Wet heaths: M15, M16
- Dry heaths: H10, H12, H18, H21
- Grasslands and bracken: U2, U4, U5, U6, U20, MG1, MG6, MG9, MG10, CG10
- Woodland and scrub: W11, W17, W18, W23, W24
- Swamp and tall-herb fens: S9
- Vegetation of open habitats: OV24, OV25, OV27

4.1.2 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.

4.1.3 The NVC survey results are displayed in **Drawings 12.11 to 12.17 (Volume 3)**. 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 detailed within Appendix A. Further photographs of a number of the typical habitat types found within the study area are provided within Appendix B.

4.1.4 For each community description, reference is made to any association 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.

#### 4.2 Mires and Flushes

4.2.1 Mires and associated bog pool and flush communities are 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*

- 4.2.2 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).
- 4.2.3 Within the study area some M1 bog pools were recorded, mainly within areas of M17, but also occasionally within M19. 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*. In places, the collective area of M1 bog pools within the mires is much less than 1% of the mire surface, so they have not been mapped separately. The presence of a number of M1 pools within areas of M17 indicates the wet nature and relatively good condition of the mire in these localities.

### M2 *Sphagnum cuspidatum*/fallax bog pool community

#### *Communities recorded: M2*

#### *Annex I, SBL, CNPA - Blanket bog*

- 4.2.4 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).
- 4.2.5 M2 was sparsely scattered within the study area, through wetter areas of M17 and M19 mire. The vegetation is dominated by pools and carpets of *S. cuspidatum* and *S. fallax*, with swards of *Eriophorum angustifolium* and *Carex rostrata* growing throughout. The pool margins often contained species such as *Erica tetralix* and *Narthecium ossifragum*.

### M3 *Eriophorum angustifolium* bog pool community

#### *Annex I, SBL, CNPA - Blanket bog*

- 4.2.6 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).

- 4.2.7 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 some 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 I – Transition mires and quaking bogs; SBL – Upland flushes, fens and swamps; CNPA – Wetlands*

- 4.2.8 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.
- 4.2.9 M4 is scattered throughout the study area, most often in small stands marking the passage and localised ponding of surface water in depressions. It is also present as a few larger stands to the west of the existing A9, in the floodplain of the River Truim, just south of the Pass of Drumochter within a larger mire complex. 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.
- 4.2.10 Other species are limited by the waterlogged substrate and shade from the *C. rostrata*: these species include *Myrica gale*, *Erica tetralix*, *Carex nigra*, *Eriophorum angustifolium* and *Molinia caerulea*. Within the lawns of *Sphagnum* spp., *S. palustre* is occasional and *S. capillifolium* and *S. squarrosum* occur rarely.
- 4.2.11 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.

#### M5 *Carex rostrata* – *Sphagnum squarrosum* mire

*GWDTE status – High; Annex I – Transition mires and quaking bogs; SBL – Upland flushes, fens and swamps; CNPA – Wetlands*

- 4.2.12 M5 mire is typically found as floating rafts or on soft, spongy peats in topogenous mires and in soligenous areas with mildly acid, only moderately calcareous and more nutrient-poor waters. It is characteristically found in zonation and mosaics. The community has a widespread but fairly local distribution in northern and western parts of Britain (Rodwell *et al* 1991; Elkington *et al* 2001).
- 4.2.13 M5 is characterised overall by the dominance of sedges with scattered poor-fen herbs over a patchy carpet of moderately base-tolerant *Sphagnum* spp. The commonest species throughout are *Carex rostrata* and *C. nigra*, with the former generally more extensive; *C. lasiocarpa* can be locally prominent. The bryophyte carpet helps define M5 mire against closely related vegetation



types; especially distinctive is the presence of *Sphagnum squarrosum* and *S. teres* (Rodwell *et al* 1991; Elkington *et al* 2001).

- 4.2.14 A single small area of M5 was recorded within the study area, as part of a mosaic with M4 and M6. It is located west of the existing A9, in the floodplain of the River Truim, just south of the Pass of Drumochter within a larger wet mire complex (which also includes M17, M19, M23 and M25). The sward was dominated by *Carex rostrata*, with occasional *C. nigra* and *C. lasiocarpa*, the community was differentiated from the surrounding abundant M4 mire by the local abundance of *Sphagnum teres*. Other species in this M5 mire here include *Angelica sylvestris*, *Geum rivale*, *Valeriana officinalis*, *Succisa pratensis*, *Eriophorum angustifolium*, *Holcus lanatus* and the mosses *Hylocomium splendens* and *Sphagnum fallax*.

#### M6 *Carex echinata* - *Sphagnum fallax/denticulatum* mire

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

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

- 4.2.15 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 *Sphagnum* (Rodwell *et al* 1991; Elkington *et al* 2001).
- 4.2.16 M6 is widespread throughout the study area, mostly as small flushes, runnels or soakways, and along and within occluding ditches and minor watercourses. Three of the four sub-communities occur within the Project 7 study area, i.e. M6a, M6c and M6d.
- 4.2.17 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 the sward. *C. rostrata*, *C. panicea* and *Eriophorum angustifolium* are also occasional to frequent in some stands. Other associates that are occasional to rare here 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.
- 4.2.18 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. 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*.
- 4.2.19 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. 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 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 lines of surface water pathways through areas of M23a.

- 4.2.20 The M6c and M6d sub-communities are of very limited grazing value and of little economic importance. In some places M6 is 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*

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

- 4.2.21 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 5.2.8, but is distinguished on the presence of a less montane assemblage, notably lacking *Saxifraga aizoides*.
- 4.2.22 This mire was generally recorded to community level, but on some occasions the **M10a *Carex demissa*-*Juncus bulbosus/kochii* sub-community** was recorded.
- 4.2.23 Within the study area, M10 flushes are frequently scattered throughout a number of habitats, generally on the lower to mid slopes east of the existing A9, often appearing abruptly from the slope. 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*, *Selaginella selaginoides*, *Eleocharis quinqueflora* and *Drosera rotundifolia*.
- 4.2.24 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.
- 4.2.25 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 GWDE, 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

*Communities recorded: M11*

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

- 4.2.26 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.
- 4.2.27 A number of M11 flushes are present within the study area, all to the east of the existing A9, and generally clustered towards the southern reaches of the Project 7 area. Many of the specific locations of M11 are included within the target notes (see Appendix A).
- 4.2.28 Within the study area, M11 was mapped to community level. However, the species assemblage most closely resembles that of the less montane M11b *Palustriella commutata* – *Eleocharis quinqueflora* sub-community. Within the study area 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*, *Thymus polytrichus*, *Erica tetralix*, *Juncus squarrosus* and *Drosera rotundifolia*. The mosses include frequent *Blindia acuta*, *Campylium stellatum* and *Scorpidium scorpioides*.
- 4.2.29 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, M17b, M17c*

*Annex 1, SBL, CNPA – Blanket bog*

- 4.2.30 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).
- 4.2.31 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.

- 4.2.32 M17 is the most common blanket mire type within the study area, with the majority of areas aligning with the **M17a *Drosera rotundifolia*-*Sphagnum* spp. sub-community**. The M17a sub-community is distinguished by the presence of extensive wet lawns of *Sphagnum* spp. and the frequency of *Drosera rotundifolia*.
- 4.2.33 The larger areas of M17a are on the level floodplain of the River Truim. Smaller fragments occupy 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 these areas include *Narthecium ossifragum*, *Potentilla erecta* and *D. rotundifolia*. *Juncus squarrosus* is present in patches. The moss layer within these areas of M17a 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*.
- 4.2.34 Although M17a is the most common mire type here, the **M17b *Cladonia* sub-community** is also occasionally present, predominately in mosaics with M17a with M17b forming a smaller percentage cover of the mosaic. This sub-community indicates a drier situation to that of M17a. Within M17b the characteristic M17 species remain, but *Sphagnum* cover and diversity is much reduced, with the main *Sphagnum* species present in M17b in the study area being *Sphagnum capillifolium*. The reduced cover of *Sphagnum* is also accompanied by *Cladonia* spp. increasing in prominence, and occasional records of *Racomitrium lanuginosum*.
- 4.2.35 One small area of the **M17c *Juncus squarrosus* - *Rhytidiadelphus loreus* sub-community** was recorded, within a larger area of M17a and distinguished by a high cover of *Juncus squarrosus* and pleurocarpous mosses.
- 4.2.36 Some small scattered bog pool communities were noted as present within wider areas of M17, particularly M17a. These included:
- M1 *Sphagnum denticulatum* bog pool community
  - M2 *Sphagnum cuspidatum/fallax* bog pool community
  - M3 *Eriophorum angustifolium* bog pool community
- 4.2.37 These communities have been described in sections 5.2.1 and 5.2.3 above. The M1 community is easily distinguished by the abundance of *S. denticulatum*; M2 by the species-poor association of *S. cuspidatum* and *S. fallax*, and M3 by the homogenous swards of *Eriophorum angustifolium*. These bog pool communities often form a small part of a polygon mosaic; in places the combined area of M1/M2/M3 bog pools is much less than 1% of the mire surface, so they have not always been mapped separately.
- 4.2.38 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 I, SBL, CNPA – Blanket bog*

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

### M20 *Eriophorum vaginatum* blanket mire

*Communities recorded: M20*

*Annex I, SBL, CNPA – Blanket bog*

- 4.2.42 M20 *Eriophorum vaginatum* blanket mire is a community characteristic of ombrogenous peats on bogs where certain treatments have greatly affected the vegetation; grazing and burning have been of greatest significance, but drainage has also played a part in the development of M20 (Rodwell *et al* 1991; Elkington *et al* 2001). It is commonest on blanket mires where these factors have contributed both to floristic impoverishment and to erosion of the peats. The peats are generally drier than in M17 and most M19 bogs, often showing surface oxidation (Rodwell *et al* 1991; Elkington *et al* 2001).
- 4.2.43 The community comprises species-poor ombrogenous bog vegetation dominated by *E. vaginatum*, the tussocks of which form an open or closed canopy 10-30 cm high. Ericoid sub-shrubs are patchy, while *Deschampsia flexuosa* is fairly common. Bryophytes tend to be sparse and patchy; *Sphagnum* spp. are scarce with *Sphagnum capillifolium* and *S. papillosum* the most usual species (Rodwell *et al* 1991; Elkington *et al* 2001).
- 4.2.44 Within the study area, a few small pockets of vegetation of indistinct character most closely resembled degraded, yet wet, M20. The vegetation contains *Eriophorum vaginatum* with some sparse *Carex* spp. and few other vascular associates; there are also some *Sphagnum* carpets.

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)*

- 4.2.45 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).
- 4.2.46 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 5.2.6).
- 4.2.47 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* 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.
- 4.2.48 The field layer beneath the *J. acutiflorus* 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.
- 4.2.49 The species commonly found in this sub-community in the study area 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*.
- 4.2.50 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 here with grasslands used as pasture; the grass sward makes it attractive to grazing animals. The soft ground conditions mean that it is locally heavily poached. M23b is also found in very small scattered stands on gentle slopes to the east of the A9, usually associated with surface water flow, or collection, in depressions.



- 4.2.51 As well as being dominated by *J. effusus*, this sub-community also differs from M23a in being more grassy and less species rich. 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, including 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 present.

#### M25 *Molinia caerulea* – *Potentilla erecta* mire

*Sub-communities recorded: M25a, M25b*

*GWDTE status – Moderate; Annex I, SBL – Blanket bog*

- 4.2.52 M25 mire is a community of moist, but usually well aerated, acid to neutral peats and peaty soils (Rodwell *et al* 1991). It generally occurs over gently-sloping ground, marking out seepage zones and flushed margins of topogenous mires, but also extends onto the fringes of ombrogenous mires (Rodwell *et al* 1991; Elkington *et al* 2001; Averis *et al* 2004). *Molinia caerulea* is the most abundant species found in this community. The associated flora is usually species-poor, and consists largely of *Juncus* spp. and a few dicotyledons. Occasionally sub-shrubs can be quite common, particularly *Calluna vulgaris* and *Erica tetralix*. *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).
- 4.2.53 M25 is not 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.
- 4.2.54 M25 sub-communities are defined according to the *M. caerulea* associates, and within the study area it predominately takes the form of the **M25a *Erica tetralix* sub-community**, indicated here by the presence of a range of wet heath and bog associates (*cf.* grasses or tall herbs indicative of the other two sub-communities).
- 4.2.55 Within the M25a 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*.
- 4.2.56 In addition to M25a, two small areas of the **M25b *Anthoxanthum odoratum* sub-community** were recorded. Here, M25b is characterised by a slightly shorter sward of *M. caerulea*, it is also drier with other grasses becoming more noticeable. Species appearing frequently in this sub-community include *Anthoxanthum odoratum*, *Agrostis* spp., *Nardus stricta*, *Festuca ovina* and *Holcus lanatus*.

#### M29 *Hypericum elodes* – *Potamogeton polygonifolius* soakway

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

- 4.2.57 The M29 community is characteristic of shallow soakways and pools in peats and peaty mineral soils with fluctuating water levels, such as seepages and runnels around mires and in heathland

pools, at low to moderate altitudes. The water is typically clear, still or gently-flowing, moderately acid to neutral, with a pH between 4 and 5.5. This community has a usually distinctive appearance, typically consisting of low creeping or floating mats of *Hypericum elodes* and *Potamogeton polygonifolius*. Very often, unless the ground has been badly trampled by grazing animals, these two constants are set in a carpet of submerged *Sphagnum denticulatum*, sometimes with *S. cuspidatum*, *S. palustre* or *S. fallax* (Rodwell *et al* 1991; Elkington *et al* 2001).

- 4.2.58 Within the study area, M29 is scarce; where present it tends to take the form of soakways, most commonly through areas of M15 wet heath. The vegetation contains abundant *Potamogeton polygonifolius* (*Hypericum elodes* was not recorded). The soakways also include frequent *Ranunculus flammula* and more occasional *Eriophorum angustifolium*, *Juncus bulbosus*, *J. acutiflorus*, *Narthecium ossifragum*, *Carex rostrata*, *C. viridula* and *C. panicea*. *Sphagna* – predominantly *Sphagnum denticulatum* – are present on the fringes and in the margins of the soakway features.

### 4.3 Wet Heaths

- 4.3.1 Wet heath makes up a large proportion of the study area, occupying many gentler sloping areas and flat areas on peat. It forms 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*

- 4.3.2 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).
- 4.3.3 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 landscape setting on gentler peaty slopes. However, the community is also 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 altered over time by grazing, burning and drainage, thereby facilitating the development of the M15 species assemblage.

- 4.3.4 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 within M15a here are *Narthecium ossifragum*, *Eriophorum angustifolium*, *Potentilla erecta*, *Juncus squarrosus*, *Carex nigra*, *Drosera rotundifolia*, *Succisa pratensis*, *Pinguicula vulgaris* and the mosses *Sphagnum denticulatum*, *S. capillifolium*, *S. fallax* and, locally, *Scorpidium scorpioides*.
- 4.3.5 By far the most common sub-community of M15 within the study area is the **M15b Typical sub-community**. M15b is extensive in many parts of the study area, where it consists mainly 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.
- 4.3.6 The M15b field layer often contains *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.
- 4.3.7 The **M15c *Cladonia* spp. sub-community** is uncommon within the study area, being recorded in one small polygon. M15c is drier than M15a and M15b and in the study area has a generally more open sward, with *Calluna vulgaris* the most abundant of the four main constituent species and typically growing with *Trichophorum germanicum*; there were also rare sprigs of *Vaccinium myrtillus* present. The ground layer largely lacks the *Sphagna* of the wetter sub-communities which are generally replaced here by mixes of pleurocarpous mosses and the lichens *Cladonia arbuscula*, *C. portentosa* and *C. uncialis*.
- 4.3.8 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, but it differs from M15c in containing 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. Many stands of M15d here 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. 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*. *J. squarrosus* and *N. stricta* are 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*. 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.

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

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

*Sub-communities recorded: M16d*

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

- 4.3.10 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.
- 4.3.11 In the study area M16 was found on damp, peaty soils in one gently sloping to flat area east of the A9, surrounded by M15b wet heath and calcifugous grasslands. This M16 vegetation consists mainly of *Calluna vulgaris*, *Erica tetralix* and *Trichophorum germanicum*, with other species including *Juncus squarrosus*, *Molinia caerulea*, the mosses *Hypnum jutlandicum* 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 this stand of M16 belongs to the **M16d *Juncus squarrosus*-*Dicranum scoparium* sub-community**.

## 4.4 Dry Heaths

4.4.1 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*. Four recognised dry heath NVC communities have been identified within the Project 7 study area, as per below.

### H10 *Calluna vulgaris* – *Erica cinerea* heath

*Communities/sub-communities recorded: H10, H10a, H10c*

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

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

4.4.3 H10 is relatively common within the Project 7 study area, mainly on shallow and dry soils on moderate to steep slopes to the east of the A9. It is frequently present in mosaics with other dry heaths, and calcifugous grasslands, as well as forming some larger homogenous stands.

4.4.4 H10 was for the most part mapped to community level, but the majority of stands are floristically closest to the species-poor **H10a Typical sub-community**. In these areas *Calluna vulgaris* is the canopy dominant. *Erica cinerea* is also abundant, and co-dominant in places. These two species characterise the community and its canopy within the study area. However, in places *Vaccinium myrtillus* is locally frequent. Also present, and more occasional within H10a, are *Carex binervis*, *Erica tetralix*, *Potentilla erecta* and *Galium saxatile*. The ground layer consists of pleurocarpous mosses and *Cladonia* spp. (lichens).

4.4.5 Two areas of the grass-rich **H10c *Festuca ovina* – *Anthoxanthum odoratum* sub-community** were recorded within the study area. The much greater abundance of grasses in the sward, along with more open *C. vulgaris* and *E. cinerea* indicates the H10c sub-community. The H10c heath is characterised by abundant *E. cinerea* with frequent to occasional *Danthonia decumbens*, *Agrostis capillaris*, *Nardus stricta*, *Anthoxanthum odoratum*, *Calluna vulgaris*, *Festuca ovina*, *Carex pilulifera*, *Potentilla erecta*, *Euphrasia officinalis*, *Galium saxatile* and *Veronica officinalis*. This H10c is evidently grazed by sheep, with the ground poached in areas.

### H12 *Calluna vulgaris* – *Vaccinium myrtillus* heath

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

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

4.4.6 H12 *Calluna vulgaris* – *Vaccinium myrtillus* heath is a typical sub-shrub community of acidic to circumneutral, free-draining mineral soils throughout the cold and wet sub-montane zone, generally between 200 m and 600 m. H12 is generally dominated by *Calluna vulgaris* although

the cover of this species can be open and degenerate. *Vaccinium myrtillus* is constant, though it is usually subordinate to *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.

- 4.4.7 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 in heaths recovering after a fire. 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*.
- 4.4.8 Two H12 sub-communities were identified during the surveys. The **H12a *Calluna vulgaris* sub-community** is by far 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 7. The slopes to the east of the A9 have the most extensive cover of H12, 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 occur on the flood plain of the River Truim where appropriate topographic conditions and levels of grazing allow.
- 4.4.9 The vegetation of a considerable proportion of the H12a consists of little more than *Calluna vulgaris* over a lawn of pleurocarpous mosses, with *Vaccinium 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: for example *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* and *R. triquetrus*. In places there are *Cladonia* spp. (lichens). Other infrequent associates include *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 *Vaccinium 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; sheep may graze as well, albeit at a low density.
- 4.4.10 The **H12c *Galium saxatile* – *Festuca ovina* sub-community** was also 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 established. The *Calluna vulgaris* cover is variable within this sub-community but it is generally shorter (<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/vinealis*. *Juncus squarrosus* is locally frequent and the typical small herbs *Galium saxatile* and *Potentilla erecta* scramble throughout, benefitting from 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.

### H18 *Vaccinium myrtillus* – *Deschampsia flexuosa* heath

*Sub-communities recorded: H18b*

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

- 4.4.11 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 that is clearly anthropogenic, H18 is common at lower altitudes as a derivative of H12 *Calluna vulgaris* – *Vaccinium myrtillus* heath where the H12 heaths have been burned and then grazed too hard to allow *Calluna vulgaris* to re-establish (Rodwell *et al* 1991; Averis *et al* 2004).
- 4.4.12 Three small areas of H18 were recorded within the study area to the east of the A9, situated within more extensive *Calluna* dominated heaths. In these areas localised burning and grazing of H12 heath has evidently resulted in conversion to H18 *Vaccinium* – *Deschampsia* heath.
- 4.4.13 The H18 present most closely resembles the **H18b *Alchemilla alpina* – *Carex pilulifera* sub-community**. In these areas *V. myrtillus* dominates along with *D. flexuosa* and *Potentilla erecta*. *C. vulgaris* is sparsely present in a short cropped and heavily grazed form. Other associates present within the H18b heath include *V. vitis-idaea*, *Galium saxatile*, *Festuca ovina*, *Nardus stricta*, *Agrostis capillaris*, *A. vinealis*, *Anthoxanthum odoratum*, *Festuca ovina*, *Carex pilulifera*, and *Alchemilla alpina*. Mosses include *Hypnum jutlandicum*, *Hylocomium splendens* and *Pleurozium schreberi*.

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

*Sub-communities recorded: H21a*

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

- 4.4.14 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 humid atmosphere. It is widespread at low to moderate altitudes in upland Britain. It is found mainly on steep, shaded slopes of north-west to easterly aspect, often with rock outcrops (Rodwell *et al* 1991; Elkington *et al* 2001).
- 4.4.15 The steeper slopes within the Project 7 study area, to the east of the A9, contain abundant H21; all of which belongs to the **H21a *Calluna vulgaris* - *Pteridium aquilinum* sub-community**. The vegetation is typically very species-poor and 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*.

## 4.5 Springs

M32 *Philonotis fontana* – *Saxifraga stellaris* spring

Communities/sub-communities recorded: M32, M32a

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

- 4.5.2 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 visually obvious by its bright green colour.
- 4.5.3 A number of M32 springs were recorded on slopes to the east of the A9, particularly towards the southern end of the study area. The vegetation is 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*, *Carex panicea*, *Geum rivale*, *Alchemilla glabra*, *A. alpina* and *Sphagnum subnitens*.
- 4.5.4 These small areas of habitat are resistant to burning and grazing because of their wet and unproductive nature. This community is a GWDTE, due to its dependency on groundwater upwelling's.

## 4.6 Calcifugous Grasslands and bracken-dominated vegetation

U2 *Deschampsia flexuosa* grassland

*Sub-communities recorded: U2, U2a*

- 4.6.2 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).
- 4.6.3 In this survey, the U2 community was often found in association with burnt heath. Typically, *D. flexuosa* forms the dominant cover and there is a heath-related element present that will probably replace the *D. flexuosa* during future succession back to heathland. This heathy element includes 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 a resemblance to the U2b *Vaccinium myrtillus* sub-community.



- 4.6.4 The more graminoid-rich **U2a *Festuca ovina* – *Agrostis capillaris* sub-community** was recorded in a few small stands. Here, the community dominant (*D. flexuosa*) is accompanied by other grasses including *Festuca ovina*, *Agrostis capillaris* and *Anthoxanthum odoratum*, as well as the herbs *Potentilla erecta* and *Galium saxatile*.
- 4.6.5 Present in only a few locations within the study area, these areas of U2 grassland may soon be replaced by heath. However, new areas of U2 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, U4c*

*U4c only: Annex I – Species-rich *Nardus* grassland; SBL – Upland calcareous grassland; CNPA - Grasslands*

- 4.6.6 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.
- 4.6.7 U4 grassland is generally identified by 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.
- 4.6.8 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, with a third sub-community isolated to two stands.
- 4.6.9 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.
- 4.6.10 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 acris*, *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 polytrichus*, but not enough to classify the vegetation as CG10 *Festuca ovina* - *Agrostis capillaris* - *Thymus polytrichus* grassland (see section 5.8.1). 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*.

- 4.6.11 Moderate to high 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.
- 4.6.12 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 including *Holcus lanatus*. In season, the flowers of frequent to abundant *T. repens* serve as another point of distinction.
- 4.6.13 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.
- 4.6.14 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*.
- 4.6.15 Valuable as pasture, this community is managed by relatively continuous grazing, although other treatments such as ploughing, re-seeding and fertiliser application may have been applied in the past to bring it into its 'semi-improved' condition.
- 4.6.16 Two small stands of U4, more closely resembling **U4c *Lathyrus montanus* – *Stachys betonica* sub-community**, were recorded where the grassland exhibited some more calcareous influences. These stands are located to the east of the A9 on lower slopes around Creag nan Ubhal, south of the Allt a' Chaorainn burn. In these areas some of the community constants (*A. capillaris*, *F. ovina* and *A. odoratum*) are joined by a more species-rich flora, including occasional *Gentianella campestris*, *Thymus polytrichus*, *Botrychium lunaria*, *Galium verum* and *Helianthemum nummularium*.

#### U5 *Nardus stricta* – *Galium saxatile* grassland

*Communities/sub-communities recorded: U5, U5a*

- 4.6.17 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 podsols 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).
- 4.6.18 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.

4.6.19 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. Often recorded to community level, most stands took the form of a single sub-community, the **U5a Species-poor sub-community**. U5a 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 acris*, *Alchemilla alpina*, *Galium saxatile*, *Viola riviniana*, *Polygala serpyllifolia*, *Potentilla erecta* and *Holcus lanatus*. *Anemone nemorosa* occurs rarely. Mosses such as *Hypnum jutlandicum*, *Hylocomium splendens* and *Pleurozium schreberi* are common.

4.6.20 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.

#### U6 *Juncus squarrosus* – *Festuca ovina* grassland

*Communities/sub-communities recorded: U6, U6a, U6b, U6d*

*GWDTE Status – Moderate*

4.6.21 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).

4.6.22 U6 is widely present in the study area, as generally small stands, often in mosaics and transitions with the local mire and wet heath communities, particularly M6, M15 and M17. U6 often appears to have been derived from these habitats by grazing. Three of the four sub-communities were recorded, U6a and U6d being the most abundant, with two small areas of U6b, as described below.

4.6.23 As would be expected *J. squarrosus* is the dominant species in each stand, irrespective of sub-community. A number of damper examples on more peaty soils and around mires correspond to the **U6a Sphagnum sub-community**. U6a is common as small stands within the study area; in these places U6a is characterised by an abundance of *Sphagna*, particularly *Sphagnum fallax*, *S. capillifolium* and *S. palustre*. *Festuca ovina* is frequent to locally abundant, and is accompanied by occasional *Eriophorum vaginatum*, *Anthoxanthum odoratum* and *Agrostis canina*. *Potentilla erecta* is also locally frequent.

4.6.24 The **U6d *Agrostis capillaris* – *Luzula multiflora* sub-community** is also frequent as small stands within the study area, especially in mosaics with M15b and M15d wet heath. The vegetation is species-poor and dominated by *J. squarrosus* with abundant to dominant *Nardus stricta* and *Polytrichum commune*, and frequent *Galium saxatile*.



- 4.6.25 The **U6b *Carex nigra* - *Calypogeia azurea* sub-community** was also noted in two small stands, in mosaics with wet heath and other U6 sub-communities. This U6b is distinguished by a high cover of *Carex nigra*, *Aulacomnium palustre* and *Plagiothecium undulatum*.

#### U20 *Pteridium aquilinum* – *Galium saxatile* community

##### *Communities recorded: U20*

- 4.6.26 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.
- 4.6.27 This community is infrequent within the study area, and occupies small areas in the southern end. It does not appear to be subject to any form of management or control.
- 4.6.28 The U20 vegetation present within the study area is dominated *P. aquilinum*, and where associates are present they are generally similar to those of the U4 grassland community. There is frequent *Agrostis capillaris*, *Festuca ovina*, *Anthoxanthum odoratum* and *Holcus lanatus*. *Galium saxatile*, *Potentilla erecta* and *Rumex acetosa* are occasional. With respect to mosses, *Rhytidiadelphus squarrosus* is abundant with frequent *Hypnum jutlandicum* and *Pseudoscleropodium purum*.

## 4.7 Mesotrophic Grasslands

### MG1 *Arrhenatherum elatius* grassland

#### *Communities recorded: MG1*

- 4.7.2 MG1 is essentially ungrazed grassland in which coarse-leaved tussock grasses are dominant in the sward. It is found on circumneutral and free draining soils throughout the British lowlands. Key to its development is the irregularity or absence of grazing (Rodwell *et al* 1992).
- 4.7.3 MG1 is widely scattered throughout the study area, in small stands. It tends to occur along road and track sides (or in close proximity to them), particularly those that have been more neglected and unmown. It is often found in mosaics with other grassland such as unmanaged U4b, and also rank weedy vegetation such as OV27.
- 4.7.4 The MG1 vegetation within the study area generally lacks much *Arrhenatherum elatius*, and is characterised more by an abundant mixture of *Dactylis glomerata* and *Holcus lanatus*. Along with these species are frequent to occasional *Festuca rubra*, *Heracleum sphondylium*, *Achillea millefolium*, *Deschampsia cespitosa*, *Plantago lanceolata*, *Cirsium arvense*, and *Rubus fruticosus* agg. (when abutting hedgerows). This community arises where there has been a lack of grazing or mowing along road verges.

### MG6 *Lolium perenne* – *Cynosurus cristatus* grassland

#### *Communities recorded: MG6*

MG6 is the major permanent pasture type on moist but freely draining circumneutral brown soils in lowland Britain, and is often found in enclosed stands. It has usually been subjected to some form of improvement such as fertiliser application and drainage, and many stands have been derived from historical ploughing and re-seeding (Rodwell *et al* 1992).

A single area of MG6 was recorded in the study area. This is a small piece of managed and mown land that forms a barrier between the main A9 carriageway and an offset lay-by at NN 62985 76735. The short mown sward consists mainly of *Lolium perenne* and *Trifolium repens*.

#### MG9 *Holcus lanatus* – *Deschampsia cespitosa* grassland

*Communities recorded: MG9*

*GWDTE Status – Moderate; CNPA – Wet grasslands*

4.7.5 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).

4.7.6 A single very small area of MG9 was recorded between the cycle path and the railway near Dalnaspidal Lodge, in the southern part of the study area. This small stand is species-poor and dominated by *Deschampsia cespitosa* with occasional *Holcus lanatus*.

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

*Communities/sub-communities recorded: MG10, MG10a*

*GWDTE Status – Moderate; CNPA – Wet grasslands*

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

4.7.8 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.

4.7.9 MG10 was found in three relatively small stands within the study area, the vegetation generally being 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*). The vegetation was typically dominated by dense tussocks of *J. effusus*, with frequent to occasional *H. lanatus* and tussocks of *Deschampsia cespitosa* and the typical species already listed for the community as a whole. The sward is generally species-poor.

## 4.8 Calcareous Grasslands

*Festuca ovina* – *Agrostis capillaris* – *Thymus polytrichus* grassland

*Communities/sub-communities recorded: CG10, CG10a, CG10c*

*GWDTE Status – High; Annex I – Species-rich Nardus grassland; SBL – Upland calcareous grassland; CNPA – Grasslands*

- 4.8.2 CG10 is a sub-montane community of base-rich and often moist brown earths which have developed over a wide variety of calcareous bedrocks and coarse-textured superficial deposits. The soils have a moderately calcareous superficial pH of 5-7. The community can be found up to 750 m in altitude, and is generally restricted to areas of cool, moist and cloudy climatic conditions in the uplands. The grassland is typically a plagioclimax vegetation maintained by grazing (usually sheep) (Rodwell *et al* 1992; Cooper, 1997).
- 4.8.3 CG10 generally occurs as swards close-cropped by grazing, and dominated by *Agrostis capillaris* and *Festuca ovina*. Other grasses tend to be more specific to particular sub-communities. Of the dicotyledons the commonest species is *Thymus polytrichus*, which tends to be abundant (Rodwell *et al* 1992; Cooper, 1997).
- 4.8.4 Small areas of CG10 are frequent within the study area, particularly in the south where there appears to be a greater frequency of calcareous influence in general (also evident by the occurrences here of M10 and M11 flushes). The CG10 within the study area also tends to be located on the slopes to the east of the A9, usually in mosaics with dry heath (H12 in particular, but also H18) and U4 grassland.
- 4.8.5 The majority of this CG10 is closely associated with U4 grassland, both communities often grading into each other and overlapping in mosaics. In the study area both these communities share a similar assemblage of species, the separation between them often depending on the relative abundances of *Thymus polytrichus* (more common in CG10) and *Galium saxatile* (more common in U4). This type of CG10 grassland in the study area is referable to the **CG10a *Trifolium repens* – *Luzula campestris* sub-community**. It is characterised by a sward of abundant *Agrostis capillaris*, *Festuca ovina* and *Anthoxanthum odoratum*. *Galium saxatile* and *Potentilla erecta* are also frequent (*G. saxatile* sparser than *T. polytrichus*), along with occasional species as listed for U4 above (particularly U4a). *Rhytidiadelphus squarrosus* is the most common moss.
- 4.8.6 Most of the vegetation takes the form of CG10a, but a single stand of the **CG10c *Saxifraga aizoides* – *Ditrichum flexicaule* sub-community** was recorded, occurring as a flushed area through H18b heath and U4a grassland on the lower western slope of Creagan Doire Dhonaich by the Pass of Drumochter (see target note S3\_6 in Appendix A, and photograph B17 in Appendix B). Additional species recorded in this narrow strip of CG10c included *Saxifraga aizoides*, *Alchemilla alpina*, *Galium boreale*, *G. sternerii*, *Carex panicea*, *Nardus stricta*, *Viola riviniana*, *Prunella vulgaris*, *Plantago lanceolata*, *Selaginella selaginoides*, *Geum rivale* and *Linum catharticum*.

## 4.9 Woodlands and Scrub

- 4.9.1 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

*Sub-communities recorded: W11a*

*SBL – Upland birchwoods; CNPA – Birch and aspen woodland*

- 4.9.2 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).
- 4.9.3 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*.
- 4.9.4 Only one area of W11 was recorded within the study area, this belonging to the **W11a *Dryopteris dilatata* sub-community**. This stand is located directly to the west of the railway, within the central study area. The vegetation composition is generally a canopy of *Betula* spp. over a grassy field layer with species including *Agrostis capillaris*, *Anthoxanthum odoratum*, *Pteridium aquilinum* and *Dryopteris dilatata*.

W17 *Quercus petraea* – *Betula pubescens* – *Dicranum majus* woodland

*Communities recorded: W17*

*SBL – Upland birchwoods; CNPA – Birch and aspen woodland*

- 4.9.5 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).
- 4.9.6 One very small area of W17 was recorded on a steep bank on the lower section of the Allt Coire Mhic-sith Burn, east of the A9 by Dalnaspidal. This stand consists of only about a dozen trees: mainly *Betula pubescens* but also some *Sorbus aucuparia* and *Salix cinerea*, over a mixed sward of typical calcifuge grasses, *Luzula sylvatica* and abundant bryophytes. Other species here include *Geranium sylvaticum*, *Alchemilla alpina* and, evidently where there is very localised base-enrichment on the steep bank, *Saxifraga aizoides*.

### W18 *Pinus sylvestris* – *Hylocomium splendens* woodland

#### *Communities recorded: W18*

- 4.9.7 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).
- 4.9.8 The few isolated stands of this community within the study area are associated with planting, primarily as shelter belts or around dwellings (e.g. Dalnaspidal Lodge), and are therefore not natural in origin. 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.
- 4.9.9 The canopy is typically and diagnostically dominated by *P. sylvestris* although there is sometimes a little *Betula* spp., *Salix cinerea* and *Sorbus aucuparia*, the broadleaves forming an understory more commonly than joining *P. sylvestris* 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*.

### W23 *Ulex europaeus* – *Rubus fruticosus* scrub

#### *Communities/sub-communities recorded: W23, W23a*

- 4.9.10 The W23 community is dominated by *Ulex europaeus* and has a usually sparse and species-poor ground flora which may be totally absent. It is a community of acidic and free draining soils on gentle to steep, rocky slopes at low altitudes. The vegetation often develops after woodland clearance of, or on, abandoned pasture (Rodwell *et al* 1991; Averis *et al* 2004).
- 4.9.11 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) or grassy (approximating to U4).
- 4.9.12 W23 and one of its sub-communities, **W23a *Anthoxanthum odoratum* sub-community**, was recorded as infrequent and small sparse patches, predominately within the southern part of the study area along roadsides or within the central reservation. The canopy consists of mainly *Cytisus scoparius*. 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. *Rubus fruticosus* is an occasional associate. The community appears unmanaged within the study area.

### W24 *Rubus fruticosus* – *Holcus lanatus* underscrub

#### *Communities recorded: W24*

- 4.9.13 *Rubus fruticosus* – *Holcus lanatus* underscrub is typically dominated by mixtures of brambles, rank grasses and tall dicotyledons. It is commonly found in close association with taller woody vegetation, in successions and zones around woodland and other scrub margins (although it generally lacks these woody species in the community itself) (Rodwell *et al* 1991).

- 4.9.14 A small amount of W24 was recorded within the central reservation at the very southern end of the study area, as part of a very heterogeneous mosaic of communities. Here, the W24 is apparent by the dense sprawling growth of *Rubus fruticosus*. Associated with the *R. fruticosus* are just a few species including *Holcus lanatus*, *Dactylis glomerata* and *Cirsium* spp.

## 4.10 Swamps and Tall-Herb Fens

### S9 *Carex rostrata* swamp

*Sub-communities recorded: S9a*

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

- 4.10.2 S9 swamp is generally a community of the north and west of Britain. 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).
- 4.10.3 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.
- 4.10.4 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 stands of this community are mostly in the floodplain of the River Truim, where surface water collects, and are often in mosaics with similar mire communities, particularly M4. No evident management effects are apparent in any of the locations from which S9 was recorded.

## 4.11 Vegetation of Open Habitats

### OV24 *Urtica dioica* – *Galium aparine* community

*Communities recorded: OV24*

- 4.11.2 OV24 is a tall-herb weed community which occurs widely throughout lowland Britain; under suitable conditions it is also found in the upland fringes. It typically occurs on disturbed, nutrient-rich soils and is frequently found around dumps of rich soil, dung or farm waste, in neglected gardens and around abandoned buildings, on waste land, and on disturbed verges and tracks (Rodwell *et al* 2000).
- 4.11.3 Within the study area there was one record of a very small area of OV24 next to the A9 carriageway, which consists of a patch of the characteristic species, *Urtica dioica* and *Galium aparine*.

### OV25 *Urtica dioica* – *Cirsium arvense* community

*Communities/sub-communities recorded: OV25, OV25a*

- 4.11.4 OV25 is a tall-herb weed community. This community is found throughout lowland Britain, on disturbed, nutrient-rich soils, usually where there are patches of bare or lightly covered ground, in which *Cirsium* spp. can establish themselves. It is typically found in poorly managed meadows,



on abandoned arable land or waste land, on disturbed verges and tracks, and in cleared woodland or young plantations (Rodwell *et al* 2000).

- 4.11.5 OV25 was occasionally recorded as small stands within the study area; primarily along roadsides, within the central reservation area, or as patches of vegetation within intensively grazed grassland areas (mainly U4) that showed signs of localised ground enrichment. The vegetation was mainly recorded to community level, but some stands were mapped as the **OV25a *Holcus lanatus* – *Poa annua* sub-community**. The OV25 vegetation within the study area consists of a limited number of species: typically abundant here are *Urtica dioica*, *Cirsium arvense*, *Holcus lanatus*, *Poa* spp. and *Rumex obtusifolius*.

#### OV27 *Chamerion angustifolium* community

- 4.11.6 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 (Rodwell *et al* 2000). It is also commonplace in regenerating conifer plantation clear-fell areas. The OV27 community is marked by the dominant tall growth of *C. angustifolium*.
- 4.11.7 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 *C. angustifolium* suppresses the underlying vegetation. Such stands are therefore mapped at the level of the community.

## 4.12 Non-NVC Communities & Categories

- 4.12.1 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)
- Mixed plantation (MP)
- Clear-fell (of plantation woodland) (CF)
- Bare ground (BG)
- Disturbed ground (DG)
- Buildings and associated driveways and private gardens (BD)
- Inland cliffs or scree slopes (IC)
- *Juncus effusus* acid grassland community (JE)
- *Juncus acutiflorus* acid grassland community (JA)
- Non-NVC neutral sedge mire (Mx)
- Scattered wood/scrub/shrubs (SWS)
- Running water (RW)
- Standing water (SW)

- 4.12.2 The plantation and clear-fell areas are unremarkable in terms of their flora and species composition. In more mature conifer plantations in particular there is often no ground flora except some scattered mosses, the ground instead being blanketed in woody debris and needles.

Younger plantations generally have 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 are floristically impoverished and of negligible botanical importance. A few small scree slopes or areas of bare rock were recorded, but these also contain little if any vegetation.

4.12.3 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 account for small scrub invasion and encroachment into heath. All of these non-NVC types recorded in the study area are of minor botanical importance and are therefore not discussed further within this report.

4.12.4 The other bulleted non-NVC vegetation types above; JE, JA and Mx, are described below.

#### *Juncus effusus* (JE) and *Juncus acutiflorus* (JA) acid grassland communities

4.12.5 The JE and JA acid grassland communities are present here as patches of a *Juncus* spp. dominated calcifuge grassland. This is vegetation in which very dominant and tall tussocks of *J. effusus* or swards of *J. acutiflorus* grow abundantly among a few shorter 'acid grassland' swards including frequent to occasional *Agrostis capillaris*, *Holcus lanatus*, *Rumex acetosa*, *Potentilla erecta* and *Galium saxatile*. This vegetation does not fit into any NVC community as it lacks the wetland element of M6 and M23 *Juncus* spp. mires and has a more acidophilous flora than MG10 *Juncus effusus* rush-pasture; it is therefore classed separately.

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

#### Neutral sedge mire (Mx)

4.12.7 Mx is neutral sedge mire lacking the acidophilous species of M6 and the basiphilous species of M10. It varies from very species-poor swards of sedges such as *Carex nigra*, *C. echinata*, *C. flacca* and *C. panicea* to richer swards with diverse assemblages of herbs and bryophytes. *Carex rostrata* is no more than sparse; if dominant the vegetation could be assigned to M5. One small patch of sedge mire in the study area was classed as Mx: this is species-poor mire with abundant *Carex nigra*, a short distance to the west of the A9, in the floodplain of the River Truim, within a larger mire complex and surrounded by M19 and M25.



## 5 Evaluation of Botanical Interest

### 5.1 Overview

5.1.1 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

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

### 5.2 Groundwater Dependent Terrestrial Ecosystems (GWDTE)

5.2.1 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 5-1** shows which communities recorded within the study area may be considered GWDTE. Those communities which may have limited (moderate) dependency on groundwater in certain settings are marked in yellow and NVC communities recorded that are likely to be considered high, or sensitive GWDTE in certain hydrogeological settings are highlighted in red.

Table 5-1: 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

NVC Code	NVC Community Name
MG10	<i>Holcus lanatus</i> – <i>Juncus effusus</i> rush pasture
JE and JA <sup>1</sup>	<i>Juncus effusus</i> and <i>Juncus acutiflorus</i> acid grassland
M5	<i>Carex rostrata</i> – <i>Sphagnum squarrosum</i> mire
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
M29	<i>Hypericum elodes</i> – <i>Potamogeton polygonifolius</i> soakway
M32	<i>Philonotis fontana</i> – <i>Saxifraga stellaris</i> spring
CG10	<i>Festuca ovina</i> – <i>Agrostis capillaris</i> – <i>Thymus polytrichus</i> grassland

5.2.2 The location and extent of all identified potential GWDTE were provided on appropriate NVC GIS polygon mapping.

5.2.3 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.

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

5.2.5 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.

<sup>1</sup> In light of the SEPA classification on potential GWDTEs these non NVC types ‘JE’ and ‘JA’ should also qualify for potential GWDTE status. The classification of moderate sensitivity is keeping in line with other similar *Juncus* spp. dominated grassland communities (e.g. MG10)

## 5.3 Annex I Habitats

### Overview

- 5.3.2 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.
- 5.3.3 Using Joint Nature Conservation Committee (JNCC) Annex I habitat listings and descriptions<sup>2</sup>, which have then been compared with survey results and field observations, the following NVC communities within the study area which constitute Annex I habitat are shown in **Table 5-2**. The locations of these Annex I habitat types were mapped using GIS. Within GIS, all polygons which contain an Annex I habitat type were shaded, irrespective of the percentage cover of Annex I habitat within that polygon. Each polygon was shaded according to the dominant Annex I type within the polygon; however, many polygons contain multiple Annex I habitat types, therefore the communities listed were cross-referenced to **Table 5-2**.
- 5.3.4 Further details on the inclusion or omission of certain NVC communities/sub-communities and/or Annex I types are also provided below.

Table 5-2: 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
M2	<i>Sphagnum cuspidatum/fallax</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
M5	<i>Carex rostrata</i> – <i>Sphagnum squarrosum</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
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, M17b, M17c	<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
M20	<i>Eriophorum vaginatum</i> blanket mire	7130	Blanket bog

<sup>2</sup> <http://jncc.defra.gov.uk/page-1523>

NVC Code	NVC Community Name	Annex I Code	Annex I Title
M25a, M25b	<i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire	7130	Blanket bog, where peat depth greater than 0.5 m
H10, H10a, 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
H18b	<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
U4c	U4c <i>Festuca ovina</i> – <i>Agrostis capillaris</i> – <i>Galium saxatile</i> grassland <i>Lathyrus montanus</i> – <i>Stachys betonica</i> sub-community	6230	Species-rich <i>Nardus</i> grassland, on siliceous substrates in mountain areas (and submountain areas in continental Europe) (U4c only)
CG10, CG10a, CG10c	<i>Festuca ovina</i> – <i>Agrostis capillaris</i> – <i>Thymus praecox</i> grassland	6230	Species-rich <i>Nardus</i> grassland, on siliceous substrates in mountain areas (and submountain areas in continental Europe)

### 7130 Blanket bog

- 5.3.5 Annex I type 7130 blanket bog correlates directly with a number of NVC communities within the study area such as the M17, M19 and M20 mires. However, 7130 blanket bog can also include the bog pool communities where these are located within the wider blanket mires (such as M17-M20). As such the M1, M2 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, M19 and M20 mire.
- 5.3.6 M25 mire and M15<sup>3</sup> 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.
- 5.3.7 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 Annex I conservation interest.

### 7140 Transition mires and quaking bogs

- 5.3.8 All examples of M4 *Carex rostrata* - *Sphagnum fallax* mire and M5 *Carex rostrata* – *Sphagnum squarrosum* mire within the study area were assigned to the Annex I type transition mires and quaking bogs. The term ‘transition mire’ relates to vegetation that in floristic composition and general ecological characteristics is transitional between acid bog and alkaline fens.

<sup>3</sup> Excluding the M15a *Carex panicea* sub-community, due to its general flushed nature over shallower substrates.

#### 4010 Northern Atlantic wet heaths with *Erica tetralix*

- 5.3.9 All examples of M15 and M16 wet heaths were included within the 4010 Northern Atlantic wet heaths category. However, as per section 5.3.2 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

- 5.3.10 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*

- 5.3.11 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.
- 5.3.12 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 floristically 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. As a result, the M11 within the study area has not been assigned an Annex I habitat type. This flora can be rich and add greatly to the diversity of upland areas, and despite not falling under the 7230 Alkaline fens category it may well be best assigned to this habitat type.

#### 4030 European dry heaths

- 5.3.13 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*.
- 5.3.14 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 four dry heath communities recorded - H10, H12, 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.
- 5.3.15 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

- 5.3.16 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 and species-rich flushed U4c calcifugous grassland sub-communities can also fall within 6230 species-rich *Nardus* grassland. This Annex I type, within the study area, is accounted for by mainly CG10, but also two small areas of U4c.

#### 91C0 Caledonian forest

- 5.3.17 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.
- 5.3.18 The only records of W18 in the study area are small areas of planted origin around buildings and shelter-belts. Therefore W18 within the study area 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

- 5.3.19 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.
- 5.3.20 Very 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 generally lack any characteristics which refer to them as ‘old sessile oak woods’.

## 5.4 Scottish Biodiversity List Priority Habitats

- 5.4.1 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.
- 5.4.2 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.
- 5.4.3 The relevant SBL priority habitat types (full descriptions of which can be found on the Biodiversity Scotland website<sup>4</sup>), and associated NVC types recorded within the study area are as follows:
- **Blanket bog:** M17, M19, M20, M1, M2 and M3 (these last three where associated with M17/M19/M20), and M15<sup>5</sup>/M16/M25 where peat depth is greater than 0.5 m

<sup>4</sup> <http://www.biodiversityscotland.gov.uk/advice-and-resources/habitat-definitions/priority/>

<sup>5</sup> Excluding the M15a *Carex panicea* sub-community, due to its general flushed nature over shallower substrates.



- **Upland flushes, fens and swamps:** M4, M5, M6, M10, M11, M23 (sub-community M23a only), M29, M32 and S9
- **Upland heathland:** M15, M16, H10, H12, H18 and H21
- Upland calcareous grassland: CG10 and U4c
- Upland birchwoods: W11 and W17

5.4.4 These SBL priority habitats correspond with UK Biodiversity Action Plan (BAP) Priority Habitats<sup>6</sup>

5.4.5 This information is also summarised in **Table 5-3** below. The locations of these SBL priority habitats were mapped using GIS. Within GIS, all polygons which contain a SBL priority habitat type were shaded, irrespective of the percentage cover of SBL priority habitat within that polygon. Each polygon was 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 were cross-referenced to **Table 5-3**.

## 5.5 Cairngorms National Park Authority Priority Habitats

5.5.1 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.

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

- **Blanket bog:** M17, M19, M20, M1, M2 and M3 (these last three where associated with M17/M19/M20)
- **Wetlands**<sup>7</sup>: M4, M5, M6, M10, M11, M23a, M29, M32 and S9
- **Wet grasslands:** M23b, MG9 and MG10
- **Upland heathland:** M15, M16, H10, H12, H18 and H21
- **Grasslands:** CG10 and U4c
- Birch and aspen woodland: W11, W17

5.5.3 This information is also summarised in **Table 5-3** below. The locations of these CNPA priority habitats were mapped using GIS. Within GIS, all polygons which contain a CNPA priority habitat type were shaded, irrespective of the percentage cover of CNPA priority habitat within that polygon. Each polygon was shaded according to the dominant CNPA priority habitat type within

<sup>6</sup> <http://jncc.defra.gov.uk/page-5718>

<sup>7</sup> 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 and swamps.

the polygon; however, many polygons contain multiple CNPA priority habitat types, therefore the communities listed were cross-referenced to **Table 5-3**.

## 5.6 Summary

5.6.1 **Table 5-3** provides a summary of all the NVC communities recorded within the study area, and any associated habitat sensitivities as described above.

Table 5-3: 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
<b>Mires and Wet Heaths</b>				
M1		7130 – Blanket bogs	Blanket bog	Blanket bog
M2		7130 – Blanket bogs	Blanket bog	Blanket bog
M3		7130 – Blanket bogs	Blanket bog	Blanket bog
M4		7140 – Transition mires and quaking bogs	Upland flushes, fens and swamps	Wetlands
M5	High	7140 – Transition mires and quaking bogs	Upland flushes, fens and swamps	Wetlands
M6, M6a, M6c, M6d	High		Upland flushes, fens and swamps	Wetlands
M10, M10a	High	7230 – Alkaline fens	Upland flushes, fens and swamps	Wetlands
M11	High		Upland flushes, fens and swamps	Wetlands
M15, M15a, M15b, M15c, M15d	Moderate	4010 – Northern Atlantic wet heaths with <i>Erica tetralix</i> <b>or</b> 7130 – Blanket bogs (where peat is greater than 0.5 m deep) (*M15a excluded from blanket bog)	Upland heathland <b>or</b> blanket bogs (where peat is greater than 0.5 m deep) (*M15a excluded from blanket bog)	Upland heathland
M16d	High	4010 – Northern Atlantic wet heaths with <i>Erica tetralix</i> <b>or</b> 7130 – Blanket bogs (where peat is greater than 0.5 m deep)	Upland heathland <b>or</b> blanket bogs (where peat is greater than 0.5 m deep)	Upland heathland
M17, M17a, M17b, M17c		7130 – Blanket bogs	Blanket bog	Blanket bog
M19, M19a		7130 – Blanket bogs	Blanket bog	Blanket bog
M20		7130 – Blanket bogs	Blanket bog	Blanket bog
M23a, M23b	High		Upland flushes, fens and swamps (applies to M23a only)	Wetlands (M23a); Wet grasslands (M23b)
M25a, M25b	Moderate	7130 – Blanket bogs (where peat is greater than 0.5 m deep)	Blanket bog (where peat is greater than 0.5 m deep)	
M29	High		Upland flushes, fens and swamps	Wetlands
M32, M32a	High		Upland flushes, fens and swamps	Wetlands
<b>Dry Heaths</b>				
H10, H10a, H10c		4030 – European dry heaths	Upland heathland	Upland heathland
H12, H12a, H12c		4030 – European dry heaths	Upland heathland	Upland heathland
H18b		4030 – European dry heaths	Upland heathland	Upland heathland

NVC Codes Recorded	Potential GWDTE Status	Annex I Type Code	SBL Priority Habitat Type	CNPA Priority Habitat Type
H21a		4030 – European dry heaths	Upland heathland	Upland heathland
<b>Calcifugous Grasslands</b>				
U2, U2a				
U4, U4a, U4b, U4c		6230 Species-rich <i>Nardus</i> grassland on siliceous substrates in mountain areas (and submountain areas in continental Europe) (*U4c only)	Upland calcareous grassland (*U4c only)	Grasslands (*U4c only)
U5, U5a				
U6, U6a, U6b, U6d	Moderate			
U20a				
<b>Mesotrophic grasslands</b>				
MG1				
MG6				
MG9	Moderate			Wet grasslands
MG10, MG10a	Moderate			Wet grasslands
<b>Calcicolous Grasslands</b>				
CG10, CG10a, CG10c	High	6230 Species-rich <i>Nardus</i> grassland on siliceous substrates in mountain areas (and submountain areas in continental Europe)	Upland calcareous grassland	Grasslands
<b>Woodland and Scrub</b>				
W11a			Upland birchwoods	Birch and aspen woodland
W17			Upland birchwoods	Birch and aspen woodland
W18				
W23, W23a				
W24				
<b>Swamps and Tall-Herb Fens</b>				
S9a			Upland flushes, fens and swamps	Wetlands
<b>Vegetation of Open Habitats</b>				
OV24				
OV25, OV25a				
OV27				

## 6 Future Survey Requirements

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

### 6.2 GWDTE

- 6.2.1 As discussed in section 5.2 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.

### 6.3 Peat Depth

- 6.3.1 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 GIS polygons was 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.

## 7 Summary

- 7.1.1 MacArthur Green carried out NVC surveys within the Project 7 study area from 20 July 2015 to 23 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.
- 7.1.2 The surveys revealed the presence of a wide range of habitat types – mainly mires, heaths and grasslands - culminating in 40 recognised NVC community types within the study area, along with a wide range of further sub-communities. Several non-NVC types were also recorded.
- 7.1.3 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 5-3**.

## 8 Glossary

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

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

**base-rich:** environments which are neutral or alkaline.

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

**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

## 10 NVC Target Notes

10.1.1 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 detailed within **Table 10-1** below. A representative sample of corresponding target note photographs is provided in Appendix B.

Table 10-1: Project 7 study area target notes

Target Note ID	Easting	Northing	NVC Community	Description	Photo reference
1	266131	772479	M6	Runnel in hollow around watercourse	
TI_1	265514	772654	M32a	Small spring within central reservation area	
TI_2	265631	772871	M32	Spring	B1
TI_3	265635	772879	M32a	Spring	B2
TI_4	265590	772853	M32	<i>Saxifraga stellaris</i> and <i>Philonotis fontana</i> at the head of a hollow channel running through the moraine hummocks	
TI_5	265592	772883	M32/M10	Large M32 grading into M10 further downslope through the hollows in the moraine	
TI_6	265443	772835	M6d	Convergence of many channels running through hollows in moraine area	B3
TI_7	265187	773249	M32/M10	Several smaller M32 flushes run into M10 area downslope	
TI_8	265135	773179	M11	Profuse growth of <i>Saxifraga aizoides</i>	
TI_9	265037	773055	M32a	Small spring	
TI_10	264962	773056	M32a	Small spring	B4
TI_11	265060	773235	M11	<i>Saxifraga aizoides</i> and small sedges dominate	
S1_1	264936	773110	M32a	Small spring	
S1_2	265000	773209	M11	Flushed slope fed by flushes from upslope	B5
S1_3	265031	773401	M15a	Small sedges including <i>Carex viridula</i> , <i>C. panicea</i> , <i>C. echinata</i> with <i>Scorpidium</i> spp. and other brown mosses	
S1_4	264716	773248	M15a	Flushed area by roadside where pooled water collects as it runs down from hillside.	
S1_5	265030	773552	M32a	Two M32 flushes merge into one downslope	B6
S1_6	264750	773399	M6d	Flushed slopes draining from the hillside - likely surface water driven	
S1_7	264631	773455	M11	Flush	
S1_8	264601	773430	M10a	Flush	
S1_9	264620	773447	M11	Flush	
S1_10	264919	773642	M10	Several M10 flushes over an area of 20 m width merge into M15 community downslope	

Target Note ID	Easting	Northing	NVC Community	Description	Photo reference
S1_11	264600	773520	M6d	<i>Juncus acutiflorus</i> soligenous community runs into main watercourse downslope	B7
S1_12	264791	773765	M11	Next to watercourse, with CG10 patches downslope	
S1_13	264791	773765	M10	Continuous with M11 community above, upslope	
S1_14	264381	774002	M6a	In channel on peat coming from M17 bog, wet hollow	
S1_15	263970	774120	M15a	Large expanse over flat ground 20-30 m wide	B8
S1_16	263965	774520	M10	M10 flushing: small sedges, <i>Narthecium ossifragum</i> , <i>Pinguicula vulgaris</i> , clubmosses, brown mosses etc.	B9
S1_17	263801	774513	M15a	Several flushed channels meet at the fence line	B10
S1_18	263691	774580	M11	Next to watercourse ravine on rocky ground: lots of small flushes as the watercourse runs down to the roadside drain	B11
S1_19	263682	774715	M15a	Wet heath species with small sedges and brown mosses; also <i>Campylopus atrovirens</i>	
S1_20	263797	774859	M10	Flush	
S2_1	263745	774879	M32a	<i>Sphagnum</i> -dominated springhead which leads into M15a flushes. Mostly <i>Sphagnum denticulatum</i>	B12
S2_2	263698	774867	M15a	Flushing	
S2_3	263582	774909	M29	Several soakways run down from the Beauly-Denny access track into a drain running parallel to the forestry plantation - siltation from restoration works on the access track.	
S2_4	263557	774978	M15a	Waterlogged seepage on shallowly sloping ground	
S2_5	263426	775257	M15a	Disturbed ground on quite deep peat in close proximity to the Beauly-Denny access track, degraded somewhat and influenced by artificial drainage in place	
S2_6	263702	775474	M15a	Few M15a flushes in area	
S2_7	263712	775524	M15a	Flushing	
S2_8	263355	775847	M15a/M3	Convergence of several drains into shallowly sloping/level ground	
S2_9	263311	775983	M15a	Several soakways converge making the ground waterlogged here	
S2_10	263415	776125	M32a	Small springhead	
S2_11	263351	776183	M10	Lots of <i>Pinguicula vulgaris</i> , <i>Carex panicea</i> and brown mosses	B13
S2_12	263335	776207	M15a	Number of flushes on slope, associated with drainage runnels.	
S2_13	263158	776331	M23b	Associated with artificial drainage ditch	
S2_14	263275	776389	M15a	Flushing	
S2_15	263225	776467	M15a	Few M15a flushes	

Target Note ID	Easting	Northing	NVC Community	Description	Photo reference
S2_16	263210	776517	M15a	Flushing	
S2_17	263220	776611	M15a	<i>Sphagnum denticulatum</i> , <i>Pinguicula vulgaris</i> , brown mosses, <i>Carex echinata</i> , <i>C. viridula</i>	
S2_18	263252	776648	M32a	Flushing on slope, some by hill drainage but also a springhead community; some <i>Philonotis fontana</i> and <i>Dicranella palustris</i> ; lots of <i>Sphagna</i> , liverworts and brown mosses. Grades into <i>Nardus stricta</i> , <i>Anthoxanthum odoratum</i> , <i>Juncus squarrosus</i> and <i>Potentilla erecta</i> downslope	
S2_19	263036	776637	M29	<i>Potamogeton polygonifolius</i> soakway running downslope into artificial drain	B14
S3_1	262885	776862	n/a	<i>Lycopodium annotinum</i> in H12 heath.	B15
S3_2	262875	776914	M15a	Several flushed runnels flow into one drainage channel which meets the roadside drain	
S3_3	262828	776967	M10/M6	M10 flush running into M6d which in turn runs into roadside drain	
S3_4	262837	777009	M11	Several flushed areas run into roadside drain: profuse growth of <i>Saxifraga aizoides</i>	
S3_5	262768	777092	M11/M32	<i>Saxifraga stellaris</i> , <i>S. aizoides</i> and <i>Philonotis fontana</i> with <i>Sphagnum subnitens</i> , <i>Campylopus atrovirens</i> , <i>Scorpidium cossonii</i> and <i>Pinguicula vulgaris</i>	B16
S3_6	262718	777262	CG10c	Narrow strip of flushed CG10c grassland with species including <i>Saxifraga aizoides</i> , <i>Alchemilla alpina</i> , <i>Galium boreale</i> and <i>G. sternerii</i> .	B17
S3_7	262715	777380	M32	Species-rich with small plants of <i>Geum rivale</i> , <i>Filipendula ulmaria</i> , <i>Alchemilla alpina</i> , <i>Viola riviniana</i>	
S3_8	262690	777582	M11	<i>Saxifraga aizoides</i> , <i>Campylium stellatum</i> , <i>Pinguicula vulgaris</i> , <i>Scorpidium</i> spp.	
S3_9	262683	777730	M32	Species-rich as above: <i>Geranium sylvaticum</i> , <i>Geum rivale</i> , <i>Alchemilla glabra</i> , <i>Alchemilla alpina</i> , <i>Pinguicula vulgaris</i> , <i>Philonotis fontana</i>	
S3_10	262680	777781	M11	<i>Saxifraga aizoides</i> flush, calcareous influence, wide flushed slope c.20 m wide across the slope, much <i>Thymus polytrichus</i> on the stony ground	
S3_11	262579	777849	M15a	Several flushed areas run into larger mire downslope	
S3_12	262758	778036	M15a	Some flushing around watercourse	
S3_13	262709	778250	M32a/M10/M11	Couple of M32 springs grading into M10 and M11 flushes	
S3_14	262861	778287	M15a	Associated with surface water drainage	
S3_15	262702	778292	M11	M11 flushing down from M32 spring, open and stony with <i>Pinguicula vulgaris</i> , <i>Saxifraga aizoides</i> , small sedges and brown mosses	B18



Target Note ID	Easting	Northing	NVC Community	Description	Photo reference
S3_16	262710	778295	M32a	Spring and water upwelling with lots of <i>Philonotis fontana</i> - grades into M11 below as per above TN	B19
S3_17	262690	778329	M15a	Flush	
S3_18	262734	778347	M32a/M10/M11	Spring with large water upwelling. <i>Philonotis fontana</i> , some <i>Sphagna</i> into brown mosses and then a M10 and M11 flushed area	B20
S3_19	262635	778417	M6c	<i>Sphagnum palustre</i> , <i>Carex echinata</i> , <i>Juncus effusus</i> associated with artificially blocked drain downslope of Beaully-Denny track	B21
S3_20	262895	778432	M10	Flushing with small sedges and <i>Pinguicula vulgaris</i>	
S3_21	262847	778473	M15a	Small sedges dominate	
S3_22	262889	778575	M15a	Flushing on slope	
S3_23	262750	778622	M15a	Abundant <i>Carex panicea</i> . Flush associated with artificial drain	
S3_24	262832	778864	M15a	Three flushed shallow channels run downslope into M15b	
S3_25	262857	778871	M15a	Two M15a flushes running into M15b downslope	B22
S3_26	263042	778869	M6	M6 runnel in heath/bog, in hollow; ombrogenous.	
S4_1	263276	779357	M15a	Few M15a flushes	
S4_2	263275	779380	M10	Few M10 flushes, stony and open	B23
S4_3	263245	779634	M6c	Running down towards forestry, associated with drainage pipe outflow	
S4_4	263531	779644	M15a	Flushing on slope	
S4_5	263453	779923	M6a	In hollow around watercourse within peaty area.	
S4_6	263318	780000	M15a	Typical wet heath species with <i>Carex viridula</i> , <i>C. panicea</i> and <i>Narthecium ossifragum</i>	
S4_7	263572	780022	M10	Three M10 flushes adjacent to each other, obviously originating from slope - GWDTE. Quite species-poor	
S4_8	263519	780127	M15a	<i>Sphagna</i> , brown mosses and lots of <i>Carex panicea</i>	
S4_9	263566	780216	M6	<i>Sphagna</i> , sedges and <i>Polytrichum commune</i> , in a depression/runnel in bog system.	
S4_10	263743	780491	M10	Number of M10 flushes, quite open and stony for most part, with lots of brown mosses, small sedges, <i>Pinguicula vulgaris</i> occasional, and some <i>Drosera rotundifolia</i>	B24
S4_11	263411	780265	M6a	Dominant <i>Carex echinata</i> with abundant <i>Sphagnum</i> spp.	
S4_12	263798	780612	M15a	Flushing around small watercourse	B25

Target Note ID	Easting	Northing	NVC Community	Description	Photo reference
S4_13	263868	780709	M15a	Number of M15a flushes: <i>Sphagnum denticulatum</i> , brown mosses, <i>Trichophorum germanicum</i> , <i>Eriophorum angustifolium</i> , <i>Narthecium ossifragum</i> , open sward.	
S4_14	263807	780787	M15a	Flush: <i>Erica tetralix</i> , <i>Trichophorum germanicum</i> , <i>Pinguicula vulgaris</i> , <i>Eriophorum angustifolium</i> , <i>Carex viridula</i> , <i>C. panicea</i> , <i>Drosera rotundifolia</i> , <i>Sphagnum denticulatum</i> . Brown mosses. In localised depression, on peat as evident from cut tracks nearby	
S4_15	263833	780794	M15a	As S4_14 but with more <i>Eriophorum angustifolium</i> and <i>Sphagna</i>	
S4_16	263810	780807	M10	Stony open flush: <i>Pinguicula vulgaris</i> , brown mosses, <i>Trichophorum germanicum</i> , small sedges, <i>Drosera rotundifolia</i> , <i>Erica tetralix</i>	
S4_17	263823	780817	M15a	Flush	
S4_18	263802	780909	M10	Couple of M10 type flushes: open and stony, <i>Pinguicula vulgaris</i> , brown mosses and small sedges	B26
S4_19	263687	780967	M15a	Flush with <i>Eriophorum angustifolium</i> , <i>Trichophorum germanicum</i> and occasional <i>Myrica gale</i>	

# Appendix B

## Target Note Photographs

# 11 Target Note Photographs

- 11.1.1 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 TI\_2.*

M32 spring originating on hillslope.





*Photograph B-2: Target note TL\_3*

M32 spring



*Photograph B-3: Target note TL\_6*

Runnels of M6d on lower hillslope, converging in foreground.





*Photograph B-4: Target note TI\_10*

Small M32 spring, upslope of the A9 (to east)



*Photograph B-5: Target note S1\_2*

Some M11 flushing in foreground with *Saxifraga aizoides*





*Photograph B-6: Target note S1\_5*

M32 springhead with flushing downslope



*Photograph B-7: Target note S1\_11*

M6d following depressions downslope towards watercourse





*Photograph B-8: Target note S1\_15*

M15a with abundant small *Carex* spp.



*Photograph B-9: Target note S1\_16*

M10 flushes





Photograph B-10: Target note S1\_17

M15a flushing with abundant small *Carex* spp.



Photograph B-11: Target note S1\_18

Profuse growth of *Saxifraga aizoides* next to watercourse





Photograph B-12: Target note S2\_1

M32a, *Sphagnum denticulatum* dominated springhead



Photograph B-13: Target note S2\_11

M10 flushing on hillslope





Photograph B-14: Target note S2\_19

M29 soakway



Photograph B-15: Target note S3\_1

Location of *Lycopodium annotinum*





*Photograph B-16: Target note S3\_5*

M32 spring and associated M11 flushing



*Photograph B-17: Target note S3\_6*

Narrow strip of CG10c flushing down slope





*Photograph B-18: Target note S3\_15*

M11 flushing downslope of M32 spring



*Photograph B-19: Target note S3\_16*

M32 spring, with M11 flushing downslope





*Photograph B-20: Target note S3\_18*

M32 spring feeding M10 and M11 open and stony flushed area





Photograph B-21: Target note S3\_19

Typical M6c



Photograph B-22: Target note S3\_25

Area of M15a flushing with abundant *Myrica gale*





*Photograph B-23: Target note S4\_2*

M10 flushing within heath



*Photograph B-24: Target note S4\_10*

Open sward M10 flushing





*Photograph B-25: Target note S4\_12*

M15a flushing around small watercourse feature



*Photograph B-26: Target note S4\_18*

Number of M10 flushes



