



ESB Asset Development (UK) Ltd

Millmoor Rig Wind Farm

Annex to Technical Appendix 8.1: Habitat Survey Report of
Additional Site Access Area

2488037

DECEMBER 2024

RSK GENERAL NOTES

Project No.: 2488037

Title: Millmoor Rig Wind Farm – Habitat Survey Report

Client: ESB Asset Development (UK) Ltd

Date: December 2024

Office: Glasgow

Status: Rev00

Authors

Robyn Maby

Hadyn Murray

Signature

Date:

13/12/24

13/12/24

**Project
manager**

Leanne Cooke

**Technical &
quality reviewer**

Ben Lappage

Signature

Date:

09/01/25

Signature

Date:

13/12/24

RSK Biocensus (RSK) has prepared this report for the sole use of the client, showing reasonable skill and care, for the intended purposes as stated in the agreement under which this work was completed. The report may not be relied upon by any other party without the express agreement of the client and RSK. No other warranty, expressed or implied, is made as to the professional advice included in this report.

Where any data supplied by the client or from other sources have been used, it has been assumed that the information is correct. No responsibility can be accepted by RSK Biocensus for inaccuracies in the data supplied by any other party. The conclusions and recommendations in this report are based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.

No part of this report may be copied or duplicated without the express permission of RSK and the party for whom it was prepared.

Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

This work has been undertaken in accordance with the quality management system of RSK Biocensus.

Switchboard: +44 (0)330 223 1074

Company contact: Enquiries@rskbiocensus.com

EXECUTIVE SUMMARY

1. This report presents the results of a Phase 1 Habitat Survey and National Vegetation Classification (NVC) survey of the Additional Site Access Area at the proposed Millmoor Rig Wind Farm, located c.20 km south-east of the town of Hawick in the Scottish Borders (centred at grid reference: NT 64825 07464).
2. The c.295 ha additional site access area largely comprises conifer plantation, marshy grassland, wet and dry heath, bracken and modified bog. There are smaller parcels of neutral grassland, improved grassland, swamp, broadleaved woodland and tall-herb and fen.
3. Twenty-three NVC communities were identified during the survey, the most prevalent habitats being conifer plantations, followed by M23 *Juncus effusus/acutiflorus* – *Galium palustre* rush – pasture and M27 *Filipendula ulmaria* – *Angelica sylvestris* mire, which are grouped around the banks and floodplains of the Carter Burn and Black Burn. The underlying acidic nature of the soils and the hydrological conditions have also resulted in many areas of bog and heathland habitats; NVC communities: H9, H12, H21 & M19.
4. Due to the extensive and prolonged disturbance of the habitats from commercial forestry activities, many habitats have become degraded, resulting in areas exhibiting elements of more than one NVC community which appear in a complex mosaic.
5. The M25, M27, MG9, MG10 and S27 communities have a moderate potential groundwater dependent terrestrial ecosystems (GWDTE) status, with M23 and W4 classified as high status. In order to determine the groundwater dependence of these habitats in more detail, further hydrology assessment will be required.
6. Of the habitats identified in the study area, H9, H12, M19, M23a, M25, M27, S9 and S26 communities fall into the UK BAP list of Priority Habitats.
7. Similarly, these same communities (H9, H12, M19, M23a, M25, M27, S9 and S26) are listed under the Scottish Biodiversity List of Priority Habitats.
8. Additionally, the H9, H12, M19, and M25 communities recorded on site qualified as UK Annex I Habitats Directive of Priority Habitats.
9. These mire, bog and heath habitats are considered to have a higher ecological significance. Although they are in a somewhat degraded state, these habitats should be avoided where possible and could additionally offer an opportunity for enhancements post-construction.
10. Peatlands, grasslands, native woodlands and freshwater habitats are additionally listed as Priority Habitats in the Scottish Borders Local Biodiversity Action Plan (2018-2028)¹.

¹ [Item No. 6 - Appendix A - Local Biodiversity Action Plan 2018-2028- Supplementary Guidance.pdf](#)

CONTENTS

1.0 INTRODUCTION.....	1
1.1 Purpose of this report	1
1.2 Landscape context	1
1.3 Development proposals	2
2.0 METHODS.....	3
2.1 Overview	3
2.2 NVC Classification.....	3
2.3 Phase 1 Habitat Survey	4
2.4 Constraints and Limitations.....	4
3.0 RESULTS	5
3.1 Summary of Phase 1 Habitat and NVC communities.....	5
3.2 Plantation woodland blocks	6
3.3 Habitats along the access roads	10
3.4 Habitats along the rides between plantation blocks	17
3.5 Habitats along the Carter Burn.....	19
3.6 Habitats along the Black Burn.....	24
4.0 EVALUATION.....	31
4.1 Groundwater Dependent Terrestrial Ecosystems (GWDTE).....	31
4.2 Conservation Interest	32
5.0 DISCUSSION.....	33
REFERENCES.....	34
FIGURES	35
APPENDIX A – NVC DATA.....	36
APPENDIX B – SPECIES LIST	43

TABLES

Table 1. Phase 1 Habitat equivalents of NVC communities in the study area.....	5
Table 2. Photographs from the plantation woodland	8
Table 3. Photographs of habitats along the access roads.....	14
Table 4 Photographs of habitats along the plantation rides.....	18
Table 5 Photographs of habitats along the Carter Burn	22
Table 6. Photographs of habitats along the Black Burn.	27
Table 7. NVC vegetation communities within the study area which may be GWDTE (SEPA, 2017). .	31
Table 8. Vascular plant species recorded in the study area in October 2024. Estimates of abundance using the DAFOR system are given for all species.	43

FIGURES

Figure 1 Study area location plan.....	35
Figure 2 Habitats map	35

1.0 INTRODUCTION

1.1 Purpose of this report

- 1.1.1 This report presents the results of a Phase 1 Habitat Survey and a National Vegetation Classification (NVC) survey within the proposed revised access area for the Millmoor Rig Wind Farm ('Proposed Development'), located c.20 km south-east of the town of Hawick in the Scottish Borders (centred at Ordnance Survey grid reference: NT 64825 07464), hereafter referred to as 'the study area' in this report. The study area boundary is shown in *Figure 1*.
- 1.1.2 A previous NVC survey and report in connection with the Proposed Development EIA Report was conducted and produced by RSK Biocensus in 2022. This report should read as an addendum to **Technical Appendix 8.1, EIA Report**.
- 1.1.3 The site access that was proposed in the EIA Report has been redesigned to avoid direct impacts on a scheduled monument. This has necessitated creating a new short section of track which leaves the existing forestry track and goes around the Scheduled Monument before rejoining the existing forestry track.
- 1.1.4 This report relates to the revised proposed access route only, which was not covered under the previous report.
- 1.1.5 The aim of the habitat survey is to identify and map the extent of the vegetation communities present within the study area to identify habitats with high ecological value (i.e., Annex I habitats; Scottish Biodiversity List (SBL) priority habitats and those which are potential ground water dependent terrestrial ecosystems (GWDTE) along the revised access route.
- 1.1.6 The survey was carried out by RSK Biocensus on the behalf of ESB Asset Development UK Ltd ('the Applicant') to support the application for these proposed works.
- 1.1.7 The survey was conducted in October 2024 by Robyn Maby (BSc, MSc) and Hadyn Murray (BSc, MRes) who are consultant ecologists at RSK Biocensus and qualifying members of the Chartered Institute for Ecology and Environmental Management (CIEEM).

1.2 Landscape context

- 1.2.1 The survey covered the proposed revised access area to the Proposed Development site. The total access survey area covers c.295 hectares. The study area largely comprises conifer plantation of varying ages and species, marshy grassland, bracken, wet modified bog, wet dwarf shrub heath and some smaller areas of improved grassland, wet dwarf shrub heath, swamp and broadleaved woodland. There are also two burns running through the study area, the Carter Burn to the north and Black Burn to the south.
- 1.2.2 When consulting aerial imagery, the surrounding land appears to be predominantly coniferous plantation blocks and improved grassland used for agricultural purposes. Whitelee Moor Nature Reserve c.5 km to the south-east is a site of European conservation importance due to its active blanket bog and heather heaths. Border Mires, Kielder –

Butterburn Special Area of Conservation (SAC) is located c.14 km south. The qualifying features of this site include blanket bogs, wet heath, dry heath, transition mires and quaking bogs².

- 1.2.3 The Carbon and Peatland map³ was used to assess the classes of peatland present within the study area. This is a planning tool which aims to identify the likely presence of areas with important carbon-rich and peat soils which may be of conservation value. The study area was predominantly mapped as Class 3 which is defined as an area where “dominant vegetation cover is not priority peatland habitat but is associated with wet and acidic type.” Soils are generally carbon-rich and peaty.⁴

1.3 Development proposals

- 1.3.1 The development proposal relating to this report is the proposed revised access route for the Proposed Development. The turbine area of the Proposed Development has previously undergone separate surveying and reporting also by RSK Biocensus in 2022.

² [UK0012923 BorderMiresKielderButterburn SACv2018.pdf](#)

³ <https://soils.environment.gov.scot/maps/thematic-maps/carbon-and-peatland-2016-map/>

⁴ [Carbon and peatland 2016 map | Scotland's soils](#)

2.0 METHODS

2.1 Overview

- 2.1.1 The survey comprised both a Phase 1 Habitat Survey and an NVC survey which covered the areas within the study area red line boundary (RLB). The survey broadly followed guidance from the Joint Nature Conservation Committee (JNCC) for the NVC (Rodwell, 2006), and the Phase 1 Habitat Survey methodology (Joint Nature Conservation Committee, 2010).
- 2.1.2 Plant nomenclature in this report follows Stace (2019) for native and naturalised species of vascular plant. Introduced species and garden varieties were identified using relevant floras. Plant names in the text are given with scientific names first, followed by the English name in brackets. Doubtful identifications are preceded by 'cf.' placed before the specific epithet where the plant is very probably the species indicated, but it could not be distinguished from similar members of the genus with certainty.

2.2 NVC Classification

- 2.2.1 The field survey was based on the NVC survey approach. The methods of the NVC were used to describe the vegetation (Rodwell 1991a, 1991b 1992, 1995, Rodwell *et al.* 2000, Rodwell 2006). NVC types were identified by observation and experience, but quadrat sampling was carried out to provide an analytical description of the vegetation communities.
- 2.2.2 Quadrat data were collected from homogeneous stands following the standard methods for identifying NVC types (Rodwell 2006). The cover of each species in each quadrat was estimated by eye and recorded on the Domin Scale (10 - over 90% cover, 9 - 76-90%, 8 - 51-75%, 7 - 34-50%, 6 - 26-33%, 5 - 11-25%, 4 - 4-10%, 3 - under 4% yet frequent, 2 - under 4% and occasional, 1 - under 4% and rare). A minimum of three quadrats were recorded in each sampled vegetation type, so that not only cover but also frequency estimates were available for each species (i.e., percentage occurrence in quadrats – e.g., a species recorded in 3 quadrats out of 5 has a frequency of 60%). Because NVC communities are determined primarily in terms of species' frequency, this facilitates the identification of NVC types, and especially improves computer matching to identify NVC types (Rodwell 2006). The two-metre square quadrat size recommended in Rodwell (2006) for short herbaceous vegetation and dwarf-shrub heaths was used, subject to what Rodwell (2006) advises about using varied quadrat shapes and sizes to cater for rank, species-poor, or awkwardly shaped patches of vegetation (e.g., narrow strips) to ensure the homogeneity of a sample.
- 2.2.3 Stands of vegetation were identified from quadrat data with the assistance of the computer-program RMAVIS (Marshall *et al.*, 2024), which computes similarity-coefficients between quadrat data and the published NVC tables in British Plant Communities (because these define the NVC communities and sub-communities). This gives only an initial indication of which NVC types the data are most likely to have been drawn from – the highest coefficient does not necessarily indicate a correct NVC diagnosis. It is always necessary to identify

the NVC type through careful consideration of the NVC descriptions in British Plant Communities (Rodwell 1991a, b, 1992, 2000).

- 2.2.4 As a result of the historic management of the study area and the habitats appearing in a mosaic, when inputting data into the RMAVIS software for analysis, the outputs were often confused and inconclusive. In these cases, the species data was assessed solely using the Rodwell (1991a, 1991b, 1992, 2000) series.
- 2.2.5 A plant species list was recorded and is given in Appendix B of this report.

2.3 Phase 1 Habitat Survey

- 2.3.1 The NVC data and mapping was transposed into the equivalent Phase 1 habitats. The Phase 1 habitat types offer more general and inclusive habitat groups and therefore a broader visual representation and overview of the study area, with the NVC data providing more detail in each specific area.

2.4 Constraints and Limitations

- 2.4.1 Some areas of grassland were grazed by livestock, and grasses can be difficult to identify in grazed swards as the identifying features have often been eaten. This can also affect the estimation of abundance, as the more palatable species are preferentially eaten.
- 2.4.2 The survey was conducted in October which is outside of the main flowering season for many species, meaning some may not have been evident and making accurate identification of grasses difficult. However, given the presence of extensive mire habitats on site with key indicator species such as woody sub-shrubs and sphagnum mosses (which are present year-round), habitat classification was deemed accurate with minor uncertainty concerning exact abundance of species.
- 2.4.3 There was restricted access to some small areas of plantation blocks due to tall deer fences. These were surveyed from the edges which was deemed to be sufficient for this habitat type.

3.0 RESULTS

3.1 Summary of Phase 1 Habitat and NVC communities

- 3.1.1 The land within the study area boundary largely comprises coniferous plantation blocks. Due to the interference from this kind of land use in natural processes and conditions, the habitats found around the plantation blocks have become disturbed, modified, and unbalanced, allowing for local invasions of species such as *Pteridium aquilinum* (Bracken), *Urtica dioica* (Common Nettle), *Chamaenerion angustifolium* (Rosebay Willowherb). Also, grasses found in abundance in the study area were *Deschampsia cespitosa* (Tufted Hair-grass) and *Molinia caerulea* (Purple Moor-grass); while these species are naturally found in wet and waterlogged soils and acidic conditions, particularly for *Molinia caerulea* (Purple Moor-grass), their abundance can also be a sign of extensive disturbance or poorly managed or altered heathlands and grasslands as both are highly competitive and tolerant of degraded and modified areas.
- 3.1.2 These conditions and processes along with the colonisation of the species mentioned above have resulted in many areas exhibiting elements of more than one NVC community which appear in a complex mosaic. In order to deal with this for the purpose of the report, the study area has been mapped using Phase 1 habitat types, which give broader groupings and overview of the habitats. Each of these Phase 1 polygons has then been labelled with the more detailed NVC codes which were found as a mosaic within the area.
- 3.1.3 As a result of the disturbance from the coniferous plantation and the habitats appearing in a mosaic, when inputting data into the RMAVIS (Marshall *et al.* 2024) software for analysis, the outputs were often confused and inconclusive. In these cases, the species data was assessed solely using the Rodwell (1991a, 1991b, 1992, 2000) series, with justification for the classifications provided in the text below.
- 3.1.4 There are broadly 23 NVC communities and non-NVC communities within the study area which correspond to 12 Phase 1 habitats. These have been summarised in *Table 1*. The Phase 1 habitat types and NVC communities are then described in more detail in the following sections and are illustrated in *Figure 2*. Species data for the study area is provided in *Appendix A* and *B*.

Table 1. Phase 1 Habitat equivalents of NVC communities in the study area.

Phase 1 Habitat	NVC Community & Non-NVC Habitats
A1.1 Broadleaved woodland	W4 <i>Betula pubescens</i> - <i>Molinia Caerulea</i> woodland W11 <i>Quercus petraea</i> – <i>Betula pubescens</i> – <i>Oxalis acetosella</i> woodland W17 <i>Quercus petraea</i> – <i>Betula pubescens</i> – <i>Dicranum majus</i> woodland
A1.2.2 Coniferous plantation woodland	The proposed 'Conifer Plantations' community in Rodwell <i>et al.</i> (2000)

A2.2 Scattered Scrub	W23 <i>Ulex europaeus</i> – <i>Rubus fruticosus</i> agg. scrub
B1 Acid grassland	U4 <i>Festuca ovina</i> - <i>Agrostis capillaris</i> - <i>Galium saxatile</i> grassland
B2.2 Semi-improved neutral grassland	MG1 <i>Arrhenatherum elatius</i> grassland MG9 <i>Holcus lanatus</i> – <i>Deschampsia cespitosa</i> grassland MG10 <i>Holcus lanatus</i> – <i>Juncus effusus</i> rush-pasture
B4 Improved grassland	MG6 <i>Lolium perenne</i> – <i>Cynosurus cristatus</i> grassland
B5 Marsh/marshy grassland	M23 <i>Juncus effusus/acutiflorus</i> – <i>Galium palustre</i> rush – pasture M25 <i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire M27 <i>Filipendula ulmaria</i> – <i>Angelica sylvestris</i> mire
C1.1 Continuous Bracken	U20 <i>Pteridium aquilinum</i> – <i>Galium saxatile</i> community
C3.1 Other tall herb and fern: ruderal	OV24 <i>Urtica dioica</i> – <i>Galium aparine</i> community OV27 <i>Chamaenerion angustifolium</i> community
D1 Dry dwarf shrub heath	H9 <i>Calluna vulgaris</i> - <i>Avenella flexuosa</i> heath H12 <i>Calluna vulgaris</i> - <i>Vaccinium myrtillus</i> heath H21 <i>Calluna vulgaris</i> - <i>Vaccinium myrtillus</i> - <i>Sphagnum capillifolium</i> heath
E1.7 Wet modified bog	M19 <i>Calluna vulgaris</i> – <i>Eriophorum vaginatum</i> blanket mire
F1 Swamp	S9 <i>Carex rostrata</i> swamp S12 <i>Typha latifolia</i> swamp S26 <i>Phragmites australis</i> – <i>Urtica dioica</i> fen

3.2 Plantation woodland blocks

- 3.2.1 Conifer plantations have been recognised in the coniferous woodland community in a review of the NVC coverage (Rodwell *et al.* 2000). The majority of the study area was made up of plantation woodland blocks. There was a variety of ages and stages, ranging from clear fell, newly planted, early mature and mature. Species included *Picea sitchensis* (Sitka Spruce), *Pinus sylvestris* (Scots Pine), *Larix decidua* (Larch), *Abies procera* (Noble Fir) and *Picea abies* (Norway Spruce).

- 3.2.2 The ground flora within plantations is generally sparse; within the study area there were mostly carpets of bryophytes in the more mature blocks including *Rhytidiadelphus loreus*, *Hylocomium splendens*, *Hylocomiadelphus triquetrus*, *Thuidium tamariscinum*, *Plagiothecium undulatum*, *Polytrichum commune*, *Plagiochila asplenioides* and *Sphagnum fallax* (**Photograph 1**). In some areas along the banks of the Black Burn there were local abundances of *Oxalis acetosella* (Wood Sorrel) and *Equisetum hyemale* (Rough Horsetail) amongst a block of mature *Pinus sylvestris*.
- 3.2.3 As well as the conifer plantation, there were also some smaller parcels of young to early-mature broadleaved and mixed plantations. The broadleaved plantations, although not naturally occurring, do show clear correlations to W11 *Quercus petraea* – *Betula pubescens* – *Oxalis acetosella* and W17 *Quercus petraea* – *Betula pubescens* – *Dicranum majus* NVC communities.
- 3.2.4 As described in Rodwell (1991a), the W11 community is a woodland dominated by Oak or Birch or a mixture of the two. *Oxalis acetosella* (Wood Sorrel) is often found amongst the understory and soils are moist and moderately acidic. In the study area, key species recorded in these parcels along the Carter Burn which uphold the W11 classification were *Quercus* sp. (Oak sp.), *Betula pubescens* (Downy Birch), *Betula pendula* (Silver Birch), *Fagus sylvatica* (Beech), *Sorbus aucuparia* (Rowan), with ground flora consisting of *Deschampsia cespitosa* (Tufted Hair-grass), *Dactylis glomerata* (Cock's-foot), *Holcus lanatus* (Yorkshire-fog), *Pteridium aquilinum* (Bracken), *Chrysosplenium oppositifolium* (Opposite-leaved Golden-saxifrage), *Oxalis acetosella* (Wood Sorrel) and *Plagiomnium undulatum* (**Photograph 2**).
- 3.2.5 The W17 community is similarly dominated by Oak and Birch, soils are highly acidic and there is a much richer contribution of bryophytes and presence of ericoid species, which both provide a key differentiation from the W11 community (Rodwell, 1991a). In this area within the study area, slightly further north of the Carter Burn, many of the same tree species were recorded, however within the ground flora, *Calluna vulgaris* (Heather) was noted but *Oxalis acetosella* (Wood Sorrel) was absent. There was also a far greater number of mosses and liverworts, including *Thuidium tamariscinum*, *Isoetecium myosuroides*, *Hypnum cupressiforme*, *Lophocolea bidentata*, *Pleurozium scherberi* and *Pseudoscleropodium purum* (**Photograph 3**).
- 3.2.6 Further south, there were two blocks of mixed plantation woodland. Access to this area was restricted due to tall deer fences so data was limited. Species recorded from the edges were *Abies procera* (Nobel Pine), *Sorbus aucuparia* (Rowan), *Betula pendula* (Silver Birch) and *Salix cinerea* (Grey Willow), with ground flora consisting of *Calluna vulgaris* (Heather), *Molina caerulea* (Purple Moor-grass), *Deschampsia cespitosa* (Tufted Hair-grass), and *Chamaenerion angustifolium* (Rosebay Willowherb). Again, although the woodland and tree species have been planted commercially, the species bear a resemblance to the following NVC communities: Conifer plantations, W4 *Betula pubescens*-*Molinia Caerulea* woodland, W17 *Quercus petraea* – *Betula pubescens* – *Dicranum majus* woodland, and OV27 *Chamaenerion angustifolium* making up parts of the ground flora community and indicative of disturbance (**Photograph 4**).
- 3.2.7 The W4 community was identified from *Betula pendula* (Silver Birch) and *Molina caerulea* (Purple Moor-grass) in this area. *Salix cinerea* (Grey Willow) and *Sorbus aucuparia* (Rowan) which were also recorded are listed as key species for this community by Rodwell

(1991a). Rodwell (1991a) states that this community often “occurs in zonations and mosaics with other vegetation types which reflect the progress of birch invasion on mire surfaces”. He also notes that it is often found alongside wet heaths with ericoid species. This fits with what was observed in the study area.

- 3.2.8 The presence of *Betula pendula* (Silver Birch) and *Sorbus aucuparia* (Rowan) with the covering of *Calluna vulgaris* (Heather) and *Molinia caerulea* (Purple Moor-grass) in the undergrowth are consistent with the description of the W17 community in the NVC guide (Rodwell, 1991a) as described above.
- 3.2.9 The OV27 community is characterised by an abundance of *Chamaenerion angustifolium* (Rosebay Willowherb) and is found on “damp, fertile soils on disturbed, often burned, ground in woodlands, on heaths, road verges, tracksides...Very commonly, stands of *C. angustifolium* vegetation are sharply marked off from their surrounds by the highly localised disturbance that has resulted in their development.” (Rodwell, 1991a). Within this woodland block in the study area, stands of *Chamaenerion angustifolium* (Rosebay Willowherb) appeared in open areas where felling had previously taken place and alongside heath vegetation.

Table 2. Photographs from the plantation woodland

Photograph	Description
	Photograph 1. Mature <i>Pinus sylvestris</i> (Scots pine) plantation with carpet of mosses.



Photograph 2. Broadleaved plantation woodland (W11).



Photograph 3. Broadleaved plantation woodland (W17).



Photograph 4. Mixed plantation woodland (W4, W17, OV27).

3.3 Habitats along the access roads

- 3.3.1 In this section, the habitats encountered adjacent to the main access road and tracks are discussed. The main access track enters the study area in the north-east coming off the A6088, and grades from hardstanding to a rockier, gravel track with well-developed verges and some colonisation of pioneer plants.

Track to the north-east

- 3.3.2 The main track initially passes a mosaic of adjacent habitats, recorded as a relatively small stand of marshy grassland on the margins of a larger extent of heath and a conifer and broadleaved plantation. Given the vegetation mosaic, characteristic species of at least three NVC communities were noted.
- 3.3.3 The vegetation adjacent to the track at the top in the north-east was tall and dense with abundant *Filipendula ulmaria* (Meadowsweet), forming one of the main structural components of the sward. The vegetation was not overly species-rich, but the species and habitat was characteristic of the M27 *Filipendula ulmaria* – *Angelica sylvestris* mire, for example the abundant *Filipendula ulmaria* (Meadowsweet), *Juncus effusus* (Soft Rush), and the gently sloping ground of the road verge (Rodwell, 1991b).
- 3.3.4 Around this stand of M27, whilst *Filipendula ulmaria* (Meadowsweet) remained abundant, other herbs were also present such as *Cirsium palustre* (Marsh Thistle) and *Geum rivale* (Water avens) and with rushes and grasses, including *Juncus effusus* (Soft Rush) and *Holcus lanatus* (Yorkshire Fog) being notably consistent. *Molinia caerulea* (Purple Moor-grass) was also recorded, with a greater abundance around the margins of the M27 community. The species assemblage was identified by the RMAVIS (Marshall *et al.*, 2024) software as the M27c *Juncus effusus*-*Holcus lanatus* sub-community. Some species listed as frequent to occasional for this sub-community (Rodwell, 1991b) were notably absent, for example, *Anthoxanthum odoratum* (Sweet Vernal-grass), *Agrostis canina* (Velvet Bent), and herbs *Mentha aquatica* (Water Mint) and *Lotus pedunculatus* (Greater Bird's-foot-trefoil). However, *Filipendula ulmaria* (Meadowsweet) along with *Juncus effusus* (Soft Rush) and *Holcus lanatus* (Yorkshire Fog), support the classification of the M27c community (**Photograph 5**).
- 3.3.5 Within this mosaic, heading south along the track, where the dominance of *Filipendula ulmaria* (Meadowsweet) reduced and the occurrence of *Molinia caerulea* (Purple Moor-grass) increased, a transition towards the M25 vegetation community was observed. The shift from the M27c to the M25 community appeared to reflect a change in soil moisture levels. The M27c was associated with wetter, more nutrient-rich conditions, dominated by tall herbs, whereas M25 is associated with drier ground conditions. It is characterised by the dominance of *Molinia caerulea* (Purple Moor-grass) and a reduction in tall forbs, with an increase in species typical of more acidic, nutrient-poor soils, such as *Potentilla erecta* (Tormentil) (Rodwell, 1991b) (**Photograph 6**).
- 3.3.6 Continuing south along the access track, adjacent to the wetter M27/M25 mosaic, the species assemblage was notably different with a clear delineation between the two areas. This vegetation community extended along the margins of the plantation block and was notably drier, grading into dense bracken to the southern margin of the community, to the north the Carter Burn. The area was colonised by frequent *Calluna vulgaris* (Heather), *Vaccinium myrtillus* (Bilberry), *Pteridium aquilinum* (Bracken), *Molinia caerulea* (Purple

Moor-grass), scattered *Urtica dioica* (Common Nettle), *Chamaenerion angustifolium* (Rosebay Willowherb) *Rubus fruticosus* agg. (Bramble), and *Cirsium arvense* (Creeping Thistle). The bryophyte layer primarily consisted of *Rhytidiadelphus squarrosus*, which was frequently noted among the ground flora. Self-seeded *Betula pendula* (Silver Birch) and *Picea sitchensis* (Sitka Spruce) were recorded at low density.

- 3.3.7 This parcel is best interpreted as the H12a *Calluna vulgaris*-*Vaccinium myrtillus* heath, *Calluna vulgaris* sub-community. This type of heath is described by Rodwell (1991b) as generally species-poor, dominated by *Calluna vulgaris* (Heather). Other sub-shrubs like *Vaccinium myrtillus* (Bilberry) and *Erica cinerea* (Bell Heather) are frequent but sparse. Vascular plants are limited, with scattered shoots of *Avenella flexuosa* (Wavy Hair-grass), *Potentilla erecta* (Tormentil), and *Pteridium aquilinum* (Bracken) being common. Ground cover is minimal, with frequent but scattered occurrences of mosses such as *Dicranum scoparium*, *Hypnum jutlandicum*, and *Pleurozium schreberi*.
- 3.3.8 Although not evident from the RMAVIS (Marshall *et al.*, 2024) output, potentially due to the mosaic nature of the vegetation community, the frequency of *Calluna vulgaris* (Heather) and *Vaccinium myrtillus* (Bilberry) with limited additional species present is characteristic of the H12a sub-community. Vascular associates listed as common include *Pteridium aquilinum* (Bracken), which was abundant here and the coverage may have suppressed other herbaceous species. As the heath vegetation graded into the more *Pteridium aquilinum* (Bracken) dominant areas, the vegetation was more characteristic of the U20 *Pteridium aquilinum*-*Galium saxatile* community (**Photograph 7**).
- 3.3.9 The description of the U20 *Pteridium aquilinum* – *Galium saxatile* community as outlined in (Rodwell, 1992), is vegetation dominated by *Pteridium aquilinum* (Bracken), which can form extensive stands. The community is most common on lower hill slopes and on marginal ground, including abandoned fields, where it forms mosaics and transitions with heaths, grasslands and woodlands.
- 3.3.10 The U20 community was recorded along the access track on the margins of the heath and on the embankments lining the track. Structurally, it was a mosaic of *Pteridium aquilinum* (Bracken), degraded heath, tall ruderal vegetation, and sunken, rush-dominated areas in roadside verges. The species recorded within this mosaic included abundant *Pteridium aquilinum* (Bracken), with frequent to occasional *Galium saxatile* (Heath Bedstraw), *Holcus lanatus* (Yorkshire-fog), *Agrostis capillaris* (Common Bent), *Molinia caerulea* (Purple Moor-grass), *Cirsium vulgare* (Spear Thistle), *Cirsium arvense* (Creeping Thistle), *Prunella vulgaris* (Selfheal), *Achillea millefolium* (Yarrow), *Plantago lanceolata* (Ribwort Plantain) and *Calluna vulgaris* (Heather). The species above are all listed within the floristic table, as in Rodwell (1992) for the U20 community. Additionally, species recorded among this mosaic included *Chamaenerion angustifolium* (Rosebay Willowherb), *Rumex obtusifolius* (Broad-leaved Dock), *Deschampsia cespitosa* (Tufted Hair-grass), along with *Juncus effusus* (Soft Ruh) and *Juncus conglomeratus* (Compact Rush) which were abundant in the wet verges. Scattered species recorded on the margins of this community, grading onto the gravel track, included *Leucanthemum vulgare* (Oxeye Daisy), *Lathyrus pratensis* (Meadow Vetchling), *Fragaria vesca* (Wild Strawberry), *Centaurea nigra* (Common Knapweed), *Tussilago farfara* (Colt's-foot) and the moss, *Calliergonella cuspidata*. These scattered species were indicative of a slightly more base-tolerant assemblage, potentially influenced by the track substrate.

- 3.3.11 In stands where *Chamaenerion angustifolium* (Rosebay Willowherb) was notably dominant, the vegetation was characteristic of the OV27 *Chamaenerion angustifolium* community and was relatively species poor (**Photograph 8**).

Western and central areas of the access track

- 3.3.12 The access track passes gaps within the plantation woodland blocks, some of which were just marginal clearings whilst others extended into rides between the blocks (described in Section 3.4). Here, the vegetation resembled the degraded heath mosaic described above, with *Calluna Vulgaris* (Heather) and scattered *Vaccinium myrtillus* (Bilberry) of the H12a community forming the main structural component of the sward. In the wider, flat gaps leading into the rides, the heathy mosaic with frequent *Pteridium aquilinum* (Bracken) graded to tussocky bog vegetation consisting mainly of *Calluna vulgaris* (Heather), *Eriophorum vaginatum* (Hare's-tail Cottongrass) and the mosses *Hypnum jutlandicum*, *Pleurozium schreberi*, *Hylocomium splendens*, *Polytrichum commune* and *Sphagnum capillifolium*, with smaller amounts of *Molinia caerulea* (Purple Moor-grass) and *Cladonia portentosa* scattered through the community. The species assemblage was characteristic of the M19 *Calluna vulgaris*-*Eriophorum vaginatum* blanket mire, colonising relatively flat surfaces of peaty soil.

Southern areas of the access track

- 3.3.13 Towards the south as the track approaches the boundary of the study area and crosses the Black Burn, the margins were lined on either side by a flat area with an unmanaged, tall sward predominantly comprising the grasses *Arrhenatherum elatius* (False Oat-grass), *Deschampsia cespitosa* (Tufted hair-grass), *Dactylis glomerata* (Cock's-foot), *Holcus lanatus* (Yorkshire-fog), *Holcus mollis* (Creeping Soft-grass), *Agrostis capillaris* (Common Bent), *Juncus effusus* (Soft Rush), with the forbs *Cirsium palustre* (Marsh Thistle), *Angelica sylvestris* (Wild Angelica), *Filipendula ulmaria* (Meadowsweet), *Centaurea nigra* (Common Knapweed), *Lathyrus pratensis* (Meadow Vetchling), *Rumex acetosa* (Common Sorrel), *Veronica chamaedrys* (Germander Speedwell), *Urtica dioica* (Common Nettle), *Heracleum sphondylium* (Hogweed), and *Achillea millefolium* (Yarrow). The predominant bryophyte recorded among the ground layer was *Rhytidiadelphus squarrosus*. The species recorded within this grassland were analysed using the RMAVIS (Marshall *et al.*, 2024) software, which identified the MG1 *Arrhenatherum elatius* grassland and the M23 *Juncus effusus/acutiflorus* – *Galium palustre* rush – pasture vegetation communities (Photograph 9).
- 3.3.14 The vegetation mosaic was structurally comprised of coarse-leaved tussock grasses, with *Arrhenatherum elatius* (False Oat-grass) and *Dactylis glomerata* (Cock's-foot) being conspicuous among the sward. The spent heads of the large umbellifer *Heracleum sphondylium* (Hogweed) were frequent throughout, along with *Cirsium palustre* (Marsh Thistle), *Centaurea nigra* (Common Knapweed), and *Urtica dioica* (Common Nettle). *Lathyrus pratensis* (Meadow Vetchling) was noted frequently, with the old growth intertwined with the grasses. The species assemblage and structure of the broad habitat was characteristic of the MG1 *Arrhenatherum elatius* grassland and has a close similarity to the description for the community (Rodwell, 1992).
- 3.3.15 In the literature, it is noted that at the height of the growing season the vegetation often becomes choked by sprawling legumes such as *Lathyrus pratensis* (Meadow Vetchling),

and trailing stems of *Galium aparine* (Cleavers) (Rodwell, 1992). This further affirms the classification as the MG1 community, as both species were recorded.

- 3.3.16 Within wetter stands of this grassland area, *Juncus effusus* (Soft Rush) contributed notably to the sward, along with the forbs *Cirsium palustre* (Marsh Thistle), *Angelica sylvestris* (Wild Angelica), *Filipendula ulmaria* (Meadowsweet). This species assemblage, with a rushy sward and the herb component was characteristic of the M23 *Juncus effusus/acutiflorus* – *Galium palustre* rush – pasture. The M23 community is described by Rodwell (1991b) as the abundance of either *Juncus effusus* (Soft-rush), or *Juncus acutiflorus* (Sharp-flowered Rush) with herb ground cover in wet agricultural grassland. Given the notable absence of *Juncus acutiflorus* (Sharp-flowered Rush) from the surveyed area, the community is best interpreted as the M23b *Juncus effusus* sub-community (**Photograph 9**).
- 3.3.17 A gravelly offshoot track to the south-west of the main access track was notably colonised by *Cytisus scoparius* (Broom), analysis using RMAVIS indicated that the species recorded were indicative of the W23 scrub community.
- 3.3.18 The W23 *Ulex europaeus* – *Rubus fruticosus* agg. scrub community is dominated by *Ulex europaeus* (Gorse) and has a usually sparse and species-poor ground flora which may be 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. In certain cases, the dominant scrub can be replaced by *Cytisus scoparius* (Broom), particularly on acidic soils (Rodwell, 1991a), as was the case in this part of the study area.
- 3.3.19 At the end of this track, in the south-west of the study area between the conifer plantation blocks, a heathland mosaic, with a notable variety of vegetation communities and transitional zones was recorded. The main extent of the area had a tall and hummocky sward predominantly comprising *Molina caerulea* (Purple Moor-grass), *Juncus effusus* (Soft Rush), *Holcus mollis* (Creeping Soft-grass), *Deschampsia cespitosa* (Tufted Hair-grass), with dense mounds of *Polytrichum commune* and *Sphagnum capillifolium*, and ground cover of *Sphagnum fallax*, *Sphagnum palustre*, *Pleurozium schreberi*, *Hylocomium splendens*. Sub-shrubs of *Calluna vulgaris* (Heather) and localised abundances of *Eriophorum vaginatum* (Hare’s-tail Cottongrass) were also recorded.
- 3.3.20 Given the mosaic nature of the species assemblage, the analysis from RMAVIS ((Marshall *et al.*, 2024) indicated affinities with numerous vegetation communities. Having reviewed the literature this mosaic was best interpreted as M6 *Carex echinata-Sphagnum fallax/denticulatum* mire, M25 *Molinia caerulea-Potentilla erecta* mire, M19 *Calluna vulgaris-Eriophorum vaginatum* blanket mire, and the H21 *Calluna vulgaris-Vaccinium myrtillus-Sphagnum capillifolium* heath (**Photograph 10**).
- 3.3.21 M6 is a community indicative of strongly waterlogged soils dominated by sedges like *Carex echinata* (Star Sedge) and Sphagnum mosses. The area was notably rush-dominant with *Juncus effusus* (Soft Rush) and *Juncus acutiflorus* (Sharp-flowered Rush) forming a main structural component with a carpet of *Polytrichum commune*.
- 3.3.22 M19 is a blanket bog community where *Eriophorum vaginatum* (Hare’s-tail Cottongrass) is a key species. In this area it was scattered but became locally abundant in patches. This, along with *Calluna vulgaris* (Heather), and *Sphagnum capillifolium*, were representative of the M19 blanket mire community.

- 3.3.23 H21 is a wet heathland community associated with peaty soils characterised by *Calluna vulgaris* (Heather), *Vaccinium myrtillus* (Bilberry), and *Sphagnum capillifolium* (Rodwell 1991b) which were all recorded here in the study area. This combination of M19 and H21 was also noted along the rides between the plantation blocks. It is common to have a transition between the communities. This is explained in further detail below in section 3.4.4.
- 3.3.24 M25 only occurs in slightly drier but still waterlogged conditions. Where *Molina caerulea* (Purple Moor-grass) was frequent among the vegetation, this was characteristic of the M25 community, which shares a lot of associated flora with the other mire and bog communities, namely *Calluna vulgaris* (Heather), *Eriophorum vaginatum* (Hare's-tail Cottongrass), the mosses *Polytrichum commune*, *Sphagnum capillifolium*, and *Sphagnum fallax*.
- 3.3.25 The presence of these communities together reflects a dynamic upland habitat influenced by variations in topography, hydrology, and grazing pressure. The H21 heath occupied the slightly drier ridges and mounds within the clearing, while M6, M19, and M25 mire communities colonised the moist, waterlogged hollows or gently sloping ground.

Table 3. Photographs of habitats along the access roads

Photograph	Description
	Photograph 5. Vegetation mosaic with M27c characteristics, evidenced by the abundance of <i>Filipendula ulmaria</i> (Meadowsweet), <i>Juncus effusus</i> (Soft Rush), and <i>Holcus lanatus</i> (Yorkshire-fog).



Photograph 6. M25 vegetation on the margins of the M27 mire.



Photograph 7. H12 grading into dense U20.



Photograph 8. OV27 lining the access track, dominating the margins of the habitat mosaic of H12 and U20.



Photograph 9. Coarse-leaved tussock grassland mosaic on the margins of the access track and adjacent the Black Burn, comprising MG1/MG9 and M23 in wetter, more herb rich areas.





Photograph 10. Complex mire and heath mosaic, colonising a large clearing between the plantation woodland and the burn.

3.4 Habitats along the rides between plantation blocks

- 3.4.1 The rides between the plantation blocks within the study area were the most degraded areas after the plantations themselves. As with other areas, these habitats largely appeared as mosaics, in varying combinations of identifiable NVC communities. The main communities recorded were M19, M25, H12 and H21.
- 3.4.2 The M19 *Calluna vulgaris* – *Eriophorum vaginatum* blanket mire is described by Rodwell (1991b) as 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. It is generally dominated by mixtures of *Eriophorum vaginatum* (Hare's-tail Cottongrass) and ericoid sub-shrubs (especially *Calluna vulgaris* (Heather)). *Sphagnum* spp. can be prominent over wetter ground but are not as luxuriant or rich as in other mire communities. Within the plantation rides, the at times, dense hummocks of *Eriophorum vaginatum* (Hare's-tail Cottongrass) and *Pleurozium schreberi* and local abundances of *Sphagnum palustre* alongside *Calluna vulgaris* (Heather) can be interpreted as this M19 community (**Photograph 11**).
- 3.4.3 In some sections, this was found to be the only NVC community. However, along other rides, additional species in and amongst this, such as *Molinia caerulea* (Purple Moor-grass), *Juncus effusus* (Soft Rush), *Vaccinium myrtillus* (Bilberry) and *Sphagnum capillifolium* were frequently identified. At regular intervals the rides were also interspersed with patches dominated by singular species such as *Calluna vulgaris* (Heather) and *Juncus effusus* (Soft Rush). The combinations of these species suggest that H12, H21 and M25 communities are also present.
- 3.4.4 M19 is floristically similar to the H21 *Calluna vulgaris* – *Vaccinium myrtillus* – *Sphagnum capillifolium* community, which is a particularly bryophyte-rich and wet type of heath, and is a common transition from M19, according to Rodwell (1991b). Along the rides in the study area where other sub-shrubs such as *Vaccinium myrtillus* (Bilberry) increased and *Eriophorum vaginatum* (Hare's-tail Cottongrass) decreased, a grading into the H21 community was observed. Species recorded which further support this classification are *Luzula sylvatica* (Great Wood-rush), *Sphagnum capillifolium*, *Hylocomium splendens*, and *Cladonia* sp.
- 3.4.5 In drier areas, where the general species diversity, and the cover of mosses was reduced, the H12 community is a closer match, and was also identified by the RMAVIS (Marshall *et al.* 2024) results. As described in the access road section (3.3.7), the H12a *Calluna vulgaris* – *Vaccinium myrtillus* (*Calluna vulgaris* sub-community) heath is relatively species poor, dominated by *Calluna vulgaris* (Heather) and with limited vascular plants, though often including *Pteridium aquilinum* (Bracken). The sections of the rides where *Calluna vulgaris* (Heather) made up the main, or only vegetation type, were therefore assigned to this H12a community. Other species also recorded along the rides which remain in line with this classification are *Juncus squarrosus* (Heath Rush), *Nardus stricta* (Mat-grass) and *Pleurozium schreberi*.
- 3.4.6 Evidence of the M25 *Molinia caerulea* – *Potentilla erecta* mire was also found (**Photographs 12-14**) amongst this mosaic of communities where there were increases in the rushes and grasses forming the main structural component of the sward in favour of

the sub-shrub layer. Species included *Molinia caerulea* (Purple Moor-grass), *Juncus effusus* (Soft Rush), *Holcus lanatus* (Yorkshire-fog), *Agrostis capillaris* (Common Bent) and *Potentilla erecta* (Tormentil).

Table 4 Photographs of habitats along the plantation rides

Photograph	Description
	<p>Photograph 11. M19 plantation ride.</p>
	<p>Photograph 12. Dense hummocks of <i>Eriophorum vaginatum</i> (Hare's-tail Cottongrass) with <i>Calluna vulgaris</i> (Heather), <i>Molinia caerulea</i> (Purple Moor-grass) and <i>Sphagnum</i> spp., (H21, M19, M25).</p>

	<p>Photograph 13. Mosaic of H12a, M19 and M25.</p>
	<p>Photograph 14. H12 and M25 mosaic.</p>

3.5 Habitats along the Carter Burn

- 3.5.1 In this section, the habitats encountered adjacent to the Carter Burn, to the north-east of the study area, are discussed. A tributary of the Carter Burn, running perpendicular to the A6088 road enters into the north of the study area boundary. Adjacent to this is an area of improved grassland with scattered rushes. The field is used for grazing livestock. The species assemblage was identified by the RMAVIS (Marshall *et al.*, 2024) software as MG6 *Lolium perenne* – *Cynosurus cristatus* grassland. This is a type of grazing pasture and is defined in the NVC guide by the short and tight sward with relatively unvaried grass

species, largely dominated by *Lolium perenne* (Perennial Rye-grass), *Cynosurus cristatus* (Crested Dog's-tail), *Festuca rubra* (Red Fescue) and *Holcus lanatus* (Yorkshire-fog). Forb species are mostly short with the most frequent being *Trifolium repens* (White Clover) (Rodwell, 1992). In the study area, although *Lolium perenne* (Perennial Rye-grass) was absent, the general physiognomy of these fields, the grass species recorded, such as *Cynosurus cristatus* (Crested Dog's-tail), *Holcus lanatus* (Yorkshire-fog), *Agrostis stolonifera* (Creeping Bent), *Anthoxanthum odoratum* (Sweet Vernal Grass), and the forb species of *Trifolium repens* (White Clover), *Cirsium arvense* (Creeping Thistle), *Ranunculus repens* (Creeping Buttercup), *Rumex acetosa* (Common Sorrel), *Bellis perennis* (Daisy), *Plantago lanceolata* (Ribwort Plantain) all confirm MG6 as the appropriate community.

- 3.5.2 Although not evident from the RMAVIS (Marshall *et al.*, 2024) output it has been identified that this grassland additionally has characteristics of the MG10 *Holcus lanatus* – *Juncus effusus* rush-pasture community. Rodwell (1992) describes the sward of this community as having tall tussocks of *Juncus effusus* (Soft Rush) amongst species-poor and short grasses on waterlogged soils, and that it has affinities with Cynosurian grasslands (e.g. MG6) from which it often originates. The field in the study area has high occurrences of scattered *Juncus effusus* (Soft Rush) amongst the short sward of grass species largely comprising *Agrostis stolonifera* (Creeping Bent) and *Holcus lanatus* (Yorkshire-fog) with waterlogging in some areas. Other species recorded from the field that further supports the MG10 classification are *Ranunculus repens* (Creeping Buttercup), *Rumex obtusifolius* (Broad-leaved Dock), *Cirsium arvense* (Creeping Thistle), *Cirsium fontanum* (Marsh Thistle), *Trifolium repens* (White Clover) and *Calliergonella cuspidate* (**Photograph 15**).
- 3.5.3 Either side of the Carter Burn the land was flat, featuring a plateau of marshy grasslands with tall, dense swards and wet waterlogged soils. From this flat terrain, the land graded up into slopes. The change in topography resulted in drier conditions leading to heath-dominated habitats which formed strips between the marshy grassland and the plantation blocks (**Photograph 16**).

Areas of marshy grassland directly adjacent to the Carter burn

- 3.5.4 The plateaus of marshy grassland have been ascribed to the M27 *Filipendula ulmaria* – *Angelica sylvestris* mire and M23 *Juncus effusus/acutiflorus* – *Galium palustre* rush – pasture NVC communities. Both of these communities are found on moist, peaty soils and are part of the Molinietalia class (Rodwell *et al.* 2000) and can therefore occupy similar regions and have parallels in structural appearances. After the conifer plantations, these communities are the most widely observed in the study area.
- 3.5.5 The M27 community is described in the NVC guide by Rodwell (1991b) as one where *Filipendula ulmaria* (Meadowsweet) becomes an “overwhelming component of the vegetation”, it is the only constant and only species to attain more than occasional frequency. It typically occurs in areas that are damp throughout most of the year, along streams or ditches and ponds or pools. These areas in the study area were dominated by *Filipendula ulmaria* (Meadowsweet), alongside *Juncus effusus* (Soft Rush), *Holcus lanatus* (Yorkshire-fog), *Molinia caerulea* (Purple Moor-grass), *Cirsium palustre* (Marsh Thistle), *Rumex acetosa* (Common Sorrel), *Geum rivale* (Water Avens) and *Angelica sylvestris* (Wild Angelica) (**Photograph 17**). The frequency of *Juncus effusus* (Soft Rush) and *Holcus*

lanatus (Yorkshire-fog) indicates the M27c *Juncus effusus*-*Holcus lanatus* sub-community. This classification was supported by the RMAVIS (Marshall *et al.*, 2024) software.

- 3.5.6 In these marshy areas, where the dominance of *Filipendula ulmaria* (Meadowsweet) reduced and the occurrences of other rushes and herbs increased, these habitats graded into the M23 *Juncus effusus/acutiflorus* – *Galium palustre* rush – pasture. Although the RMAVIS (Marshall *et al.*, 2024) output was also M27 for these regions, this shift in the vegetation assemblage leads to a closer alignment with an M23 classification.
- 3.5.7 The M23 community is characterised by Rodwell (1991b) as the abundance of either *Juncus effusus* (Soft-rush), or *Juncus acutiflorus* (Sharp-flowered Rush) with a herb ground cover in wet agricultural grassland. This type of rush-pasture is generally found on gently-sloping ground and around the margins of flushes and poorly drained pastures.
- 3.5.8 Within the M23 habitat found in the study area, the sward was still tall and dense with the same topography as the M27 mire. The constant species listed in this community that were present are *Holcus lanatus* (Yorkshire-fog), *Juncus effusus* (Soft Rush) and *Juncus acutiflorus* (Sharp-flowered Rush). Other species recorded, which also appear in the floristic tables (as in Rodwell, 1991b) for this community were: *Cardamine pratensis* (Cuckooflower), *Deschampsia cespitosa* (Tufted Hair-grass), *Epilobium* sp., (Willowherb sp.), *Filipendula ulmaria* (Meadowsweet), *Angelica sylvestris* (Wild Angelica) and *Viola palustris* (Marsh Violet). *Cruciata laevipes* (Crosswort) was additionally recorded in relatively high frequencies, although it is not listed as a species in the Rodwell (1991b) literature, the overall assemblage still aligns best with the M23 mire.

Areas of heathland between marshy grassland and plantation blocks

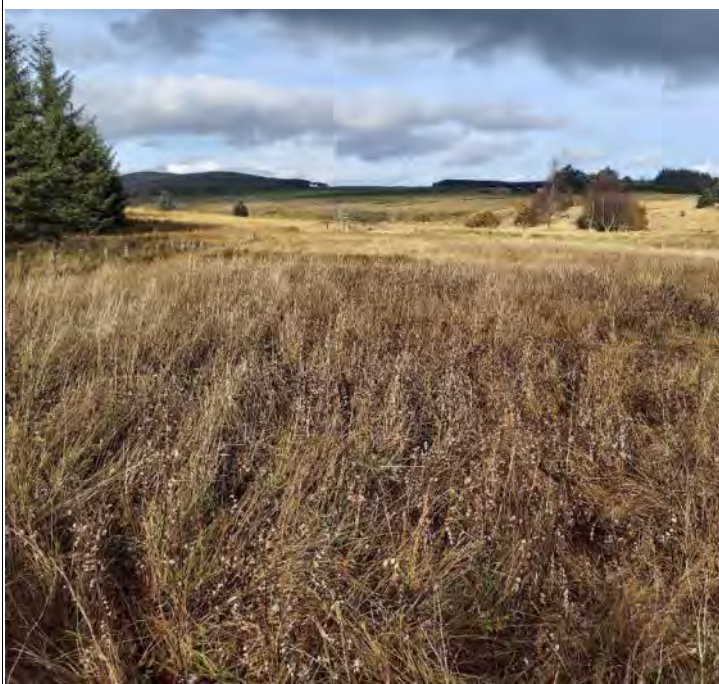
- 3.5.9 On the higher ground up from the mire and rush-pastures there were strips of heath bordering the conifer plantations. These parcels of heath are best interpreted as the H12 *Calluna vulgaris*-*Vaccinium myrtillus* heath. This type of heath is described by Rodwell (1991b) as being dominated by *Calluna vulgaris* (Heather) and with a high frequency of *Vaccinium myrtillus* (Bilberry) and moderate frequency of *Avenella flexuosa* (Wavy Hair-grass), but with a limited contribution of any herbs. This description largely fits with what was noted in the study area with the other constants of *Hypnum jutlandicum* and *Pleurozium schreberi* mosses also recorded. However, *Molinia caerulea* (Purple Moor-grass) also occurred regularly which is stated to be much rarer in the H12 heath by Rodwell (1991b). This may be attributed to the suboptimal condition of the habitats within the study area, as described previously, which can allow for the encroachment of species such as *Molinia caerulea* (Purple Moor-grass) on degraded heathlands.
- 3.5.10 In the ‘zonation and succession’ section, Rodwell (1991b) notes that the M25 *Molinia caerulea*-*Potentilla erecta* mire often occurs “with other mire communities, heaths and grasslands in zonations and mosaics”. Although not identified by the software, reoccurring recordings of *Molinia caerulea* (Purple Moor-grass), *Potentilla erecta* (Tormentil), with occasional *Juncus effusus* (Soft Rush) and *Juncus acutiflorus* (Sharp-flowered Rush), *Nardus stricta* (Mat-grass) and *Erica tetralix* (Cross-leaved Heath) amongst the H12 heath, suggest a mosaic of this with the M25 mire is present in these areas of the study area (Photograph 18).
- 3.5.11 Amongst some of these heath and mire mosaics, *Eriophorum vaginatum* (Hare’s-tail Cottongrass) was also locally abundant. This is a key species in identifying bog habitats

and indicates the presence of an additional community. *Eriophorum vaginatum* (Hare's-tail Cottongrass) along with *Calluna vulgaris* (Heather), *Erica tetralix* (Cross-leaved Heath) and *Pleurozium scheberi* were all recorded, which align with the M19 *Calluna vulgaris* – *Eriophorum vaginatum* blanket mire and appear as constant species in the literature (Rodwell 1991b). In these areas, all three (H12, M25 & M19) could be identified in tandem.

- 3.5.12 Scattered between these communities described above, there were also numerous areas dominated by *Pteridium aquilinum* (Bracken). These can be identified as the U20 *Pteridium aquilinum* – *Galium saxatile* community, which has been described in more detail in the access road section (3.3.10).

Table 5 Photographs of habitats along the Carter Burn

Photograph	Description
	Photograph 15. Improved grassland with scattered rushes (MG6 & MG10).
	Photograph 16. M23 and M27 habitats on a plateau along the burn, rising up into heath (H12) and then conifer plantation.



Photograph 17. *Filipendula ulmaria* (Meadowsweet) dominated banks (M27).



Photograph 18. *Calluna vulgaris* (Heather), *Vaccinium myrtillus* (Bilberry) and *Molinia caerulea* (Purple Moor-grass) forming a mosaic of H12 and M25.



Photograph 19. M27 grading into U20, M25 and H12 with plantation in the background.

3.6 Habitats along the Black Burn

- 3.6.1 In this section the habitats encountered adjacent to the Black Burn, along the north-west to south-west boundary of the study area, are discussed.

Areas along the Black Burn to the south-east

- 3.6.2 The access track crosses the Black Burn at the south-east corner of the study area, following the burn west leads to a flat area with a mosaic of communities present. Extensive coverage of *Pteridium aquilinum* (Bracken), scattered and locally abundant areas of *Salix cinerea* (Grey Willow), *Sorbus aucuparia* (Rowan), and *Picea sitchensis* (Sitka Spruce). *Calluna vulgaris* (Heather) was recorded throughout but notably abundant on the margins of these areas grading onto drier slopes. The species assemblage was identified by the RMAVIS (Marshall *et al.*, 2024) as the U20 *Pteridium aquilinum*-*Galium saxatile* community and the H12 *Calluna vulgaris*-*Vaccinium myrtillus* heath. Analysis of the sparsely wooded areas and associated ground flora were best interpreted as the W11 *Quercus petraea*-*Betula pubescens*-*Oxalis acetosella* woodland.
- 3.6.3 Like the U20 community described in Section 3.3, this stand was the typical *Pteridium aquilinum* (Bracken) vegetation recorded across the study area. Being so close to the burn, the soil moisture appeared to be higher, having an influence on the ground flora, with a greater richness in forbs. Species included, *Viola palustris* (Marsh Violet), *Oxalis acetosella* (Wood-sorrel), *Epilobium* sp., and *Angelica sylvestris* (Wild Angelica). The heath influence was noted throughout with *Calluna vulgaris* (Heather) recorded occasionally. The characteristics of the H12 heath community were more pronounced where the flatter area graded towards drier, well drained slopes and areas of overhang across the burn. Here the vegetation was clearly representative of this heath community with abundant *Calluna vulgaris* (Heather), *Vaccinium myrtillus* (Bilberry), occasional *Molinia caerulea* (Purple

Moor-grass), *Blechnum spicant* (Hard-fern) and a bryophyte layer consisting of *Pleurozium schreberi* and *Hypnum jutlandicum*.

- 3.6.4 The W11 woodland was fragmented across the extent of the vegetation mosaic, with notable areas of a denser canopy lining the burn. As described in the literature, this is a woodland typically of moist but free-draining and quite base-poor soils (Rodwell, 1991a). This acidity and soil moisture was evidenced by the surrounding flora, namely the coverage of the U20 and H12 vegetation (Photograph 20). The species associated with the woodland included *Sorbus aucuparia* (Rowan), *Salix cinerea* (Grey Willow), *Quercus robur* (Pedunculate Oak), with a ground layer comprising *Dactylis glomerata* (Cock's-foot), *Deschampsia cespitosa* (Tufted Hair-grass), occasional *Geranium robertianum* (Herb-Robert), *Oxalis acetosella* (Wood-sorrel), *Urtica dioica* (Common Nettle), *Stellaria holostea* (Greater Stitchwort), and encroaching *Pteridium aquilinum* (Bracken). The notable frequency of *Quercus robur* (Pedunculate Oak) and the constancy of *Oxalis acetosella* (Wood-sorrel) indicated some affinity with the W11d *Stellaria holostea*-*Hypericum pulchrum* sub-community.
- 3.6.5 On both sides of the burn, the land was on a plateau, characterised by large extents of marshy grasslands with tall, dense vegetation and waterlogged soils. From this flat area, the terrain gradually sloped upwards, transitioning into drier conditions. This shift in topography gave way to heathland which colonised these drier strips, in a similar fashion to the habitats recorded around the Carter Burn.

Central and northern areas along the Black Burn

- 3.6.6 Moving along the river, the dense U20 mosaic habitat transitioned towards a wetter mosaic of vegetation with a tussocky sward of *Juncus effusus* (Soft Rush), *Juncus acutiflorus* (Sharp-flowered Rush), *Deschampsia cespitosa* (Tufted Hair-grass), *Cirsium palustre* (Marsh Thistle), with *Angelica sylvestris* (Wild Angelica), and *Valeriana officinalis* (Common Valerian) conspicuous among the ground flora.
- 3.6.7 This combination reflects a vegetation mosaic where wet pasture communities dominated by rushes transition into mesotrophic grasslands characterised by a mix of grasses and occasional wetland species. Analysis of this species assemblage using RMAVIS (Marshall *et al.*, 2024) indicated a mosaic of the M23 *Juncus effusus/acutiflorus*-*Galium palustre* rush-pasture, MG9 *Holcus lanatus* – *Deschampsia cespitosa* grassland, and the MG10 *Holcus lanatus* – *Juncus effusus* rush-pasture. Given the abundance of *Juncus effusus* (Soft Rush) within the sward and the herbs present, the predominant vegetation community is characteristic of the M23b *Juncus effusus* sub-community (Photograph 23). This community stretched from the central area of the Black Burn, all the way along into the north-west of the study area.
- 3.6.8 The M23 community, typically forms in areas of prolonged waterlogging, often influenced by groundwater or surface runoff. MG9 and MG10 represent wetter mesotrophic systems, commonly found in areas that experience intermittent flooding or less severe waterlogging than M23 communities (Rodwell, 1992). These communities are found on moist, peaty and mineral soils, and are part of the Molinietalia class (Rodwell *et al.* 2000). Therefore, they can occupy similar regions with an overlap of these communities.
- 3.6.9 This mosaic suggests a gradient where shifts in soil moisture, nutrient levels, or management practices have created overlapping conditions. In such areas, indicator


species of M23b, such as *Juncus effusus* (soft rush), and *Galium palustre* (Marsh-bedstraw), alongside mesotrophic grassland species like *Deschampsia cespitosa* (Tufted Hair-grass), and *Holcus lanatus* (Yorkshire fog) were all frequently recorded.

- 3.6.10 Adjacent to the wetland mosaic colonising the plateau along the burn, a heath mosaic was noted on a raised, drier area. This influence of topography resulting in a shift of vegetation community was recorded consistently along the extent of the burn. The species recorded and the variation in moisture levels were characteristic of H9 *Calluna vulgaris*–*Avenella flexuosa* heath and M25 *Molinia caerulea*–*Potentilla erecta* mire.
- 3.6.11 The combination of H9 and M25 represents a habitat mosaic commonly found in upland or marginal upland landscapes. These habitats typically occur on acidic soils with low fertility, where hydrological variations and topographical differences influence vegetation patterns. H9 is a heathland associated with dry to moderately damp acidic soils and is characterised by *Calluna vulgaris* (Heather) and *Avenella flexuosa* (Wavy Hair-grass). In contrast, M25 is a wet acid grassland or mire community, dominated by *Molinia caerulea* (Purple Moor-grass) and *Potentilla erecta* (Tormentil), and is indicative of areas with moist to waterlogged soils (Rodwell, 1991b).
- 3.6.12 The presence of this a mosaic indicates varying soil moisture levels and drainage conditions (likely influenced by the conifer plantation and management), with H9 typically occupying the drier, better-drained areas (e.g., slopes) and M25 colonising wetter, more poorly drained depressions.

Swamp communities in the central area along the Black Burn

- 3.6.13 Several areas of standing water were recorded in proximity to the burn, ranging in size and depth. One of the smaller waterbodies recorded was within the rush-pasture and wet mesotrophic grassland mosaic, the margins of which were colonised by a tall, tussocky sward. Relatively little open water was evident due to the density of the *Carex rostrata* (Bottle Sedge). The dominance of this species and the associated habitat were characteristic of the S9 *Carex rostrata* swamp, which is noted in the literature as swamp vegetation of shallow to moderately deep, mesotrophic to oligotrophic, standing waters with organic substrates (Rodwell, 1995).
- 3.6.14 A larger waterbody recorded within a transitional area of rush-pasture and heath had more diverse vegetation. The species assemblage included the recognisable S9 *Carex rostrata* swamp and an additional community at the margins. Analysis of the species using RMAVIS (Marshall *et al.*, 2024) identified it as the S12 *Typha latifolia* swamp. In the literature, *Typha latifolia* (Bulrush) is always dominant in the S12 community, colonising standing mesotrophic to eutrophic waters (Rodwell, 1995), which was evident at the study area.
- 3.6.15 In the ‘zonation and succession’ section, Rodwell (1995) notes that these communities can occur together where the S12 transitions through the S12d *Carex rostrata* sub-community in less eutrophic water, to purer stands of S9 in deeper water.
- 3.6.16 The largest assemblage of swamp/fen vegetation recorded adjacent to the burn was a flat area dominated by *Phragmites australis* (Common Reed). Despite the dominance of the reed, *Urtica dioica* (Common Nettle) was occasional to frequent among the ground flora along with the scattered moss, *Kindbergia praelonga*. Given the species recorded and the surrounding habitat, this assemblage was ascribed to the S26 *Phragmites australis*–*Urtica dioica* fen community (**Photograph 26**).

Table 6. Photographs of habitats along the Black Burn.

Photograph	Description
	<p>Photograph 20. Dense <i>Pteridium aquilinum</i> (Bracken) cover of the U20 community with W11 on the margins of the burn.</p>
	<p>Photograph 21. U20 colonising the flatter area, with the H12 becoming dominant on the drier slopes.</p>



Photograph 22.
U20/M23/MG9 mosaic.



Photograph 23. Extensive
rush-pasture and mesotrophic
grassland mosaic colonising
the banks of the burn,
comprising the
M23b/MG9/MG10 vegetation
communities.



Photograph 24. H9/M25 mosaic with a local abundance of *Avenella flexuosa* (Wavy Hair-grass) colonising drier, raised mounds, and *Molinia caerulea* (Purple moor-grass) within the depression of the plantation.



Photograph 25. S9 *Carex rostrata* swamp with marginal colonisation of S12 *Typha latifolia* swamp



Photograph 26. S26
Phragmites australis
(Common Reed) dominated
fen.



Photograph 27. Dominant
M23a colonising flat plateau
adjacent to the burn, on the
north-west boundary of the
study area.

4.0 EVALUATION

4.1 Groundwater Dependent Terrestrial Ecosystems (GWDTE)

- 4.1.1 Ecosystems (wetlands) that critically depend upon groundwater represent the ecological quality of the underlying groundwater bodies. The hydrological linkage between groundwater and the wetland ecosystems that depend upon the groundwater is crucial and habitats can be sensitive to the changes in the groundwater quality and supply that can be affected by development activities.
- 4.1.2 The Scottish Environment Protection Agency (SEPA, 2017) has classified a number of NVC plant communities as having the potential to be GWDTE, with the level of dependency linked to the hydrological setting of the habitat. Many communities listed are widespread and common across Scotland, with some having relatively low ecological or botanical value.
- 4.1.3 Designation of a vegetation community as GWDTE does not therefore infer an intrinsic biodiversity value, and GWDTE status has not been used as a criterion to determine a habitats respective conservation importance. Using SEPA's (2017) guidance, Table 7 below shows each community within the study area and the habitats which may need to be considered as potential GWDTE. Communities which may have moderate dependency are marked in yellow and those considered to be high are marked as red.

Table 7. NVC vegetation communities within the study area which may be GWDTE (SEPA, 2017).

NVC Code	NVC Community Name	Potential GWDTE Status
M23	<i>Juncus effusus/acutiflorus</i> – <i>Galium palustre</i> rush - pasture	High
M25	<i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire	Moderate
M27	<i>Filipendula ulmaria</i> - <i>Angelica sylvestris</i> tall-herb fen	Moderate
MG9	<i>Holcus lanatus</i> – <i>Deschampsia cespitosa</i> grassland	Moderate
MG10	<i>Holcus lanatus</i> – <i>Juncus effusus</i> rush-pasture	Moderate
S27	<i>Carex rostrata</i> – <i>Potentilla palustris</i> tall-herb fen	Moderate
W4	<i>Betula pubescens</i> – <i>Molinia caerulea</i> woodland	High

4.2 Conservation Interest

- 4.2.1 The M23a *Juncus effusus/acutiflorus* – *Galium palustre* rush – pasture *Juncus acutiflorus* subcommunity, M27 *Filipendula ulmaria-Angelica sylvestris* tall-herb fen and S9 *Carex rostrata* swamp vegetation communities identified within the study area corresponds with the Fen, marsh and swamp: Upland flushes, fens and swamps Priority Habitat listed on the Scottish Biodiversity List (SBL) and the UK Biodiversity Action Plan (UKBAP).
- 4.2.2 The S26 *Phragmites australis* – *Urtica dioica* fen community is also listed under Fen, marsh and swamp: Reedbeds on the UK BAP and SBL list of Priority Habitats.
- 4.2.3 Upland flushes, fens and swamps are considered to be important habitats due to them being sensitive to environmental changes and the fact that they often support a diverse range of species, including invertebrates, amphibians and birds. They also have a hydrological importance in regulating water flow and therefore flood mitigation. Many, as in this study area, also appear on peaty soils which store carbon. These habitats have become rarer due to human activities such as livestock grazing, draining and burning.
- 4.2.4 The M19 *Calluna-Eriophorum* NVC community identified within the study area corresponds to the Blanket Bog Priority Habitat listed on the SBL, UKBAP and Annex I Priority Habitats. The M25 *Molinia caerulea* – *Potentilla erecta* mire vegetation community also falls under this classification when on deep peat.
- 4.2.5 Blanket bog is an important habitat type as it supports a range of common to internationally important vascular plant species and bryophytes. Blanket bogs serve as important carbon stores, which can be compromised due to anthropogenic impact.
- 4.2.6 The H9 *Calluna vulgaris* – *Avenella flexuosa* heath and H12 *Calluna vulgaris* - *Vaccinium myrtillus* heath communities fall into the Dwarf shrub heath: Upland heathland Priority Habitats, as outlined on the UKBAP and SBL Priority Habitat list, the vegetation communities are also classified as European Dry Heaths Annex I priority Habitats. This habitat type is a priority for nature conservation due to the unique plant communities it supports, which in turn offer shelter and foraging opportunities for birds, mammals and invertebrates. This type of habitat is also largely found on acidic and peaty soils and are vulnerable to losses and fragmentation from agricultural practices such as overgrazing and burning and forestry plantations.
- 4.2.7 The W11 *Quercus petraea* – *Betula pubescens* – *Oxalis acetosella* & W17 *Quercus petraea* – *Betula pubescens* – *Dicranum majus* woodland communities are considered as Broadleaved woodland: Upland birchwoods (W11) and Upland oakwoods (W11 & W17) which are noted in the UKBAP and SBL Priority Habitat list. This is due to the diverse understory of plants they support, particularly lichens, mosses and ferns. They can provide deadwood niches for species of beetles and fungi as well as habitat for birds and mammals such as red squirrel and pine marten. Many areas have become fragmented and vulnerable from human activities.
- 4.2.8 Additionally, rivers and streams are on the UK BAP, SBL and Annex I lists which would include the Carter Burn and Black Burn in the study area.
- 4.2.9 None of the plant species recorded within the study area boundary is listed on the SBL of terrestrial species.

5.0 DISCUSSION

- 5.1.1 The study area is predominantly made up of plantation woodland blocks, with some more varied habitats found clustered around the banks of the Carter Burn and Black Burn. Overall, the vegetation found during the NVC survey amongst these blocks suggested that the mires, heaths and grassland are acidic in nature, with frequent occurrences of species such as *Calluna vulgaris* (Heather), *Avenella flexuosa* (Wavy Hair-grass), *Vaccinium myrtillus* (Bilberry), *Eriophorum vaginatum* (Hare's-tail Cottongrass) and *Molinia caerulea* (Purple Moor-grass). This is verified by a review of the national soil map of Scotland⁵, which shows soils within the study area are peaty gleys and nutrient poor blanket peat. However, the habitats were found to be in a generally poor and degraded condition due to the extent of commercial forestry activities, leading to many of them occurring in complex mosaics alongside one another. This was evident from localised abundances of species such as *Molinia caerulea* (Purple Moor-grass), *Deschampsia cespitosa* (Tufted Hair-grass), *Pteridium aquilinum* (Bracken) and *Chamaenerion angustifolium* (Rosebay Willowherb).
- 5.1.2 The M25, M27, MG9, MG10 and S27 communities have a moderate potential GWDTE status, with M23 and W4 classified as high status. In order to determine the groundwater dependence of these habitats in more detail, further hydrological assessment has been undertaken in **Chapter 4, FEI Report**.
- 5.1.3 Of the habitats identified in the study area, H9, H12, M19, M23a, M25, M27, S9 and S26 communities fall into the UK BAP list of Priority Habitats.
- 5.1.4 Similarly, these same communities (H9, H12, M19, M23a, M25, M27, S9 and S26) are listed under the SBL of Priority Habitats.
- 5.1.5 Additionally, the H9, H12, M19, and M25 communities recorded on site qualified as UK Annex I Habitats Directive of Priority Habitats.
- 5.1.6 These mire, bog and heath habitats are considered to have a higher ecological significance. Although they are in a somewhat degraded state, these habitats should be avoided where possible and could additionally offer an opportunity for enhancements post-construction; however, any such opportunities are incidental and do not form part of the Outline Biodiversity Enhancement and Habitat Management Plan (**Updated Technical Appendix 8.5, FEI Report**).
- 5.1.7 Peatlands, grasslands, native woodlands and freshwater habitats are additionally listed as Priority Habitats in the Scottish Borders Local Biodiversity Action Plan (2018-2028)⁶.

⁵ [National soil map of Scotland | Scotland's soils](#)

⁶ [Item No. 6 - Appendix A - Local Biodiversity Action Plan 2018-2028- Supplementary Guidance.pdf](#)

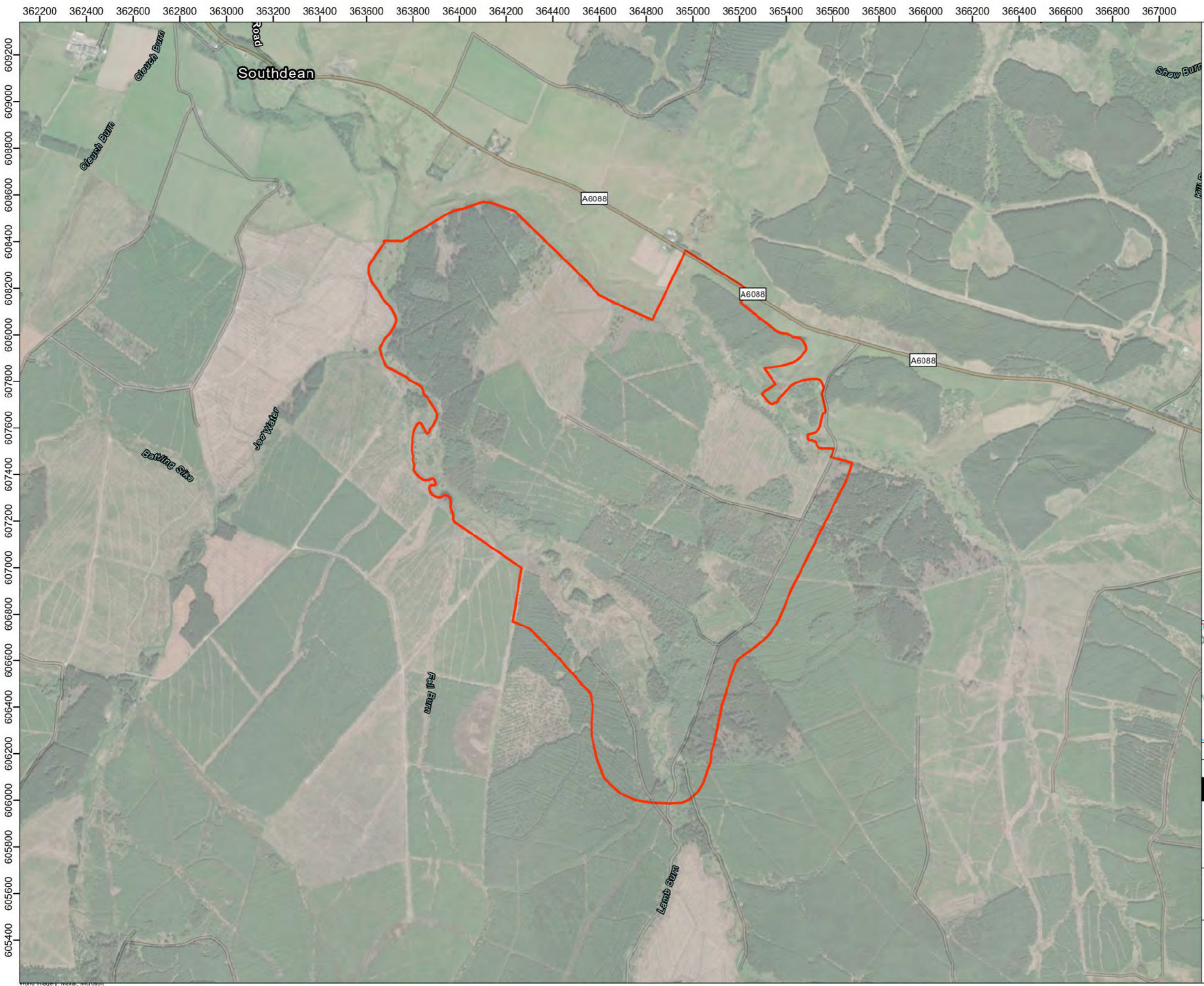
REFERENCES

- Averis, A.M. *et al.* (2004), *An illustrated guide to British upland vegetation*. Joint Nature Conservation Committee, Exeter.
- Elkington, N. *et al.* (2001), *National Vegetation Classification: Field guide to mires and heaths*. Joint Nature Conservation Committee, Peterborough.
- Marshall *et al.*, (2024) RMAVIS v1.0: a Shiny application for the analysis of vegetation survey data and assignment to GB NVC communities. *Journal of Open Source Software*, 9(100), 6682, <https://doi.org/10.21105/joss.06682>
- Marshall *et al.*, (2024)
- Rodwell, J.S. (1991a), *British Plant Communities 1: Woodlands and scrub*. Cambridge University Press, Cambridge.
- Rodwell, J.S. (1991b), *British Plant Communities 2: Mires and heaths*. Cambridge University Press, Cambridge.
- Rodwell, J.S. (1992), *British Plant Communities 3: Grasslands and Montane Communities*. Cambridge University Press, Cambridge.
- Rodwell, J.S. (1995), *British Plant Communities 4: Aquatic communities, swamps and tall-herb fens*. Cambridge University Press, Cambridge.
- Rodwell, J.S. (2000), *British Plant Communities 5: Maritime communities and vegetation of open habitats*. Cambridge University Press, Cambridge.
- Rodwell, J.S., Dring, J.C., Averis, A.B.G., Proctor, M.C.F., Malloch, A.J.C., Schaminee, J.H.J. & Dargie, T.C.D. (2000). *Review of Coverage of the National Vegetation Classification*. Joint Nature Conservation Committee, Peterborough.
- Rodwell, J.S. (2006), *National Vegetation Classification: User's Handbook*. Joint Nature Conservation Committee, Peterborough.
- Scottish Government (2013), *Scottish Biodiversity List*. Available at: [Scottish Biodiversity List | NatureScot](#)
- SEPA (2017), *Guidance Note 13: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems*
- Stace, C.A. (2019), *New Flora of the British Isles* (4th edition). C & M Floristics, Middlewood Green.

FIGURES

Figure 1 Study area location plan

Figure 2 Habitats map



Legend:
 Study area boundary



00	20/11/2024	2488037	TG	SP	LC
Rev	Date	Project Code	Drn	Chk	App

MMR FEI Briefing



TITLE: Figure 1:
Study Area Plan

0190380570

Metres

SCALE: 1:15,000 @ A3

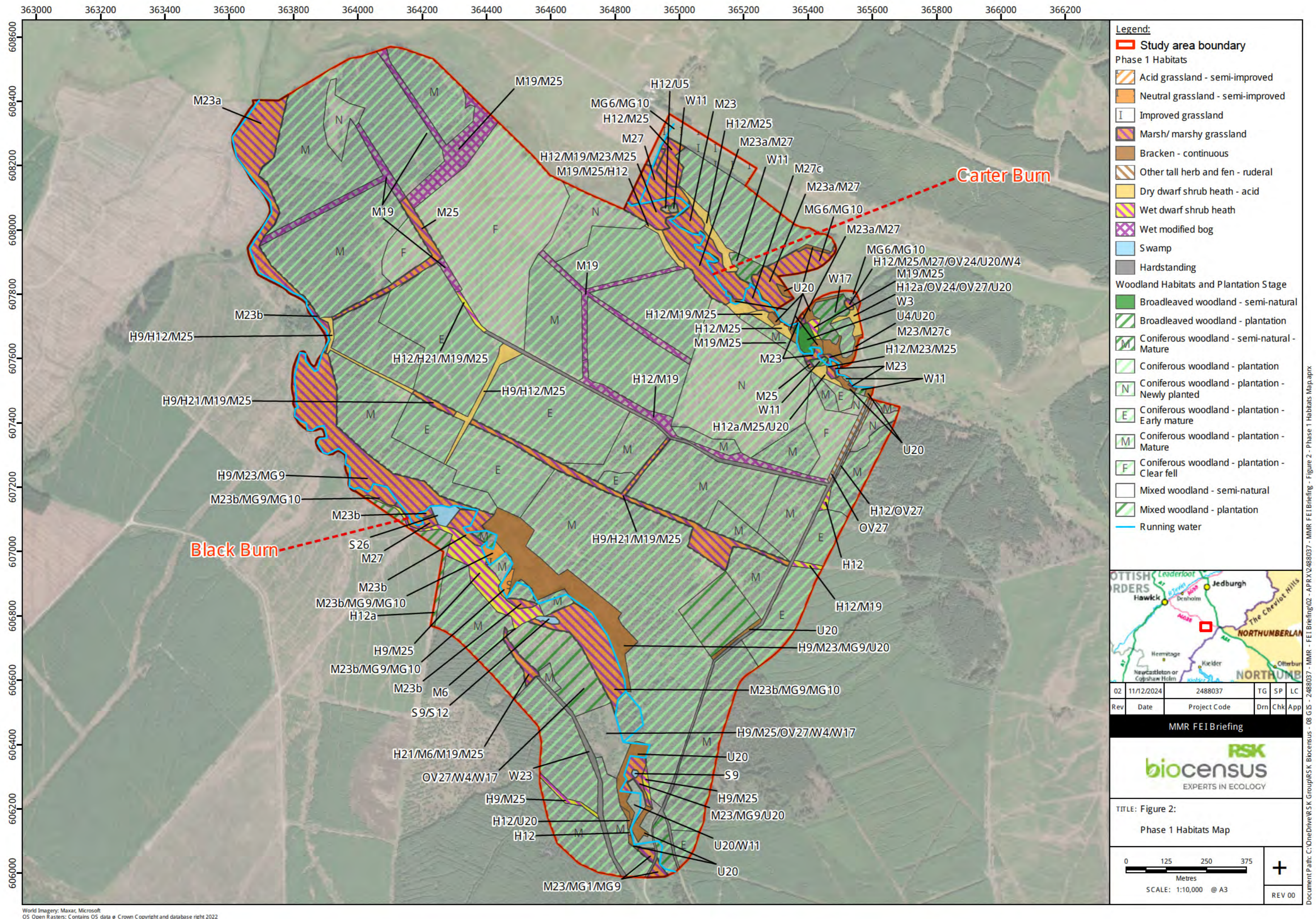
N

W

E

S

REV 00



APPENDIX A – NVC DATA

The following tables present the data for 2 x 2 m quadrats from relatively homogenous stands of vegetation within the study area. Given the mosaic nature of the vegetation, sampling homogenous stands of vegetation allowed for clearer analysis of the predominant vegetation communities that contributed the extensive mosaics. Listed below are the species recorded, constancy across the quadrats, and the identified NVC communities. The term frequency is used to describe how often a species is encountered in different stands or samples of a vegetation community type, irrespective of the abundance of that species present in each sample. It is summarised in the tables below using the Roman numerals I–V. I = 1–20% (i.e. 1 stand in 5), II = 21–40%, III = 41–60%, IV = 61–80%, V = 81–100%.

Quadrat group	OS grid reference	
A	NT 65071 08261	
Species	Frequency	
<i>Cerastium fontanum</i>	V	
<i>Cynosurus cristatus</i>	V	
<i>Deschampsia cespitosa</i>	V	
<i>Holcus lanatus</i>	V	
<i>Juncus acutiflorus</i>	V	
<i>Juncus effusus</i>	V	
<i>Ranunculus repens</i>	V	
<i>Rhytidadelphus squarrosus</i>	V	
<i>Rumex acetosa</i>	V	
<i>Rumex obtusifolius</i>	V	
<i>Trifolium repens</i>	V	
<i>Agrostis stolonifera</i>	IV	
<i>Anthoxanthum odoratum</i>	IV	
<i>Cardamine pratensis</i>	IV	
<i>Filipendula ulmaria</i>	IV	
<i>Galium saxatile</i>	IV	
<i>Hylocomium splendens</i>	IV	
<i>Juncus conglomeratus</i>	IV	
<i>Lathyrus pratensis</i>	IV	
<i>Luzula multiflora</i>	IV	
<i>Agrostis capillaris</i>	II	
<i>Bellis perennis</i>	II	
<i>Calliergonella cuspidata</i>	II	
<i>Cirsium arvense</i>	II	

Quadrat group	OS grid reference	
<i>Cirsium palustre</i>	II	
<i>Molinia caerulea</i>	II	
<i>Plantago lanceolata</i>	II	
<i>Pteridium aquilinum</i>	II	
<i>Urtica dioica</i>	II	
NVC Community	MG6 <i>Lolium perenne</i> – <i>Cynosurus cristatus</i> grassland and MG10 MG10 <i>Holcus lanatus</i> – <i>Juncus effusus</i> rush-pasture	
Notes	Nutrient enriched grazed grassland with areas of waterlogged soil.	

Quadrat group	OS grid reference	
B	NT 63677 08302	
Species	Frequency	
<i>Angelica sylvestris</i>	V	
<i>Deschampsia cespitosa</i>	V	
<i>Juncus effusus</i>	V	
<i>Rumex acetosa</i>	IV	
<i>Dactylis glomerata</i>	III	
<i>Cirsium palustre</i>	II	
<i>Deschampsia flexuosa</i>	II	
<i>Epilobium</i>	II	
<i>Filipendula ulmaria</i>	II	
<i>Galium saxatile</i>	II	
<i>Juncus acutiflorus</i>	II	
<i>Ranunculus repens</i>	II	
<i>Rhytidadelphus squarrosus</i>	II	
<i>Veronica chamaedrys</i>	II	
<i>Arrhenatherum elatius</i>	I	
<i>Cardamine pratensis</i>	I	
<i>Centaurea nigra</i>	I	
<i>Cirsium arvense</i>	I	
<i>Cruciata laevipes</i>	I	
<i>Galium aparine</i>	I	
<i>Heracleum sphondylium</i>	I	
<i>Holcus mollis</i>	I	
<i>Hylocomium splendens</i>	I	
<i>Lathyrus palustris</i>	I	
<i>Lophocolea bidentata</i>	I	
<i>Ranunculus acris</i>	I	
<i>Sphagnum fallax</i>	I	
<i>Stellaria</i>	I	
<i>Urtica dioica</i>	I	
<i>Viola palustris</i>	I	
NVC Community	M23a <i>Juncus effusus/acutiflorus</i> - <i>Galium palustre</i> rush-pasture, <i>Juncus acutiflorus</i> sub-community/M27 <i>Filipendula ulmaria</i> – <i>Angelica sylvestris</i> mire	
Notes	Large extent of marshy grassland lining burn, with a tall, unmanaged sward.	

Quadrat group	OS grid reference	
C	NT 65587 07487	
Species	Frequency	
<i>Calluna vulgaris</i>	V	
<i>Molinia caerulea</i>	V	
<i>Pteridium aquilinum</i>	IV	
<i>Rhytidiadelphus squarrosus</i>	III	
<i>Vaccinium myrtillus</i>	III	
<i>Juncus squarrosus</i>	I	
<i>Sphagnum capillifolium</i>	I	
<i>Luzula sylvatica</i>)	I	
<i>Deschampsia cespitosa</i>	I	
<i>Pleurozium schreberi</i>	I	
<i>Potentilla erecta</i>	I	
<i>Agrostis capillaris</i>	I	
<i>Polytrichum commune</i>	I	
<i>Hylocomium splendens</i>	I	
<i>Luzula multiflora</i>	I	
<i>Gallium saxatile</i>	I	
<i>Avenella flexuosa</i>	I	
<i>Holcus mollis</i>	I	
<i>Betula pendula</i>	I	
<i>Picea sitchensis</i>	I	
<i>Urtica dioica</i>	I	
<i>Chamaenerion angustifolium</i>	I	
<i>Rubus fruticosus</i> agg.	I	
NVC Community	U20 <i>Pteridium aquilinum</i> - <i>Gallium saxatile</i> heath/ H12 <i>Calluna vulgaris</i> - <i>Vaccinium myrtillus</i> heath/ OV27 <i>Chamaenerion angustifolium</i> community	
Notes	Marginal area of conifer plantation, adjacent to bracken dominated area, grading from dense bracken into more mixed area with some conifer and broadleaf saplings.	

Quadrat group	OS grid reference	
D	NT 65433 07566	
Species	Cover	
<i>Calluna vulgaris</i>	V	
<i>Molinia caerulea</i>	V	
<i>Pleurozium schreberi</i>	IV	
<i>Blechnum spicant</i>	III	
<i>Deschampsia cespitosa</i>	III	
<i>Eriophorum vaginatum</i>	III	
<i>Galium saxatile</i>	III	
<i>Vaccinium myrtillus</i>	III	
<i>Deschampsia flexuosa</i>	II	
<i>Juncus effusus</i>	II	
<i>Potentilla erecta</i>	II	
<i>Sphagnum capillifolium</i>	II	
<i>Sphagnum fallax</i>	II	
<i>Cladonia portentosa</i>	I	
<i>Digitalis purpurea</i>	I	
<i>Dryopteris filix-mas</i>	I	
<i>Erica tetralix</i>	I	
<i>Hypnum jutlandicum</i>	I	
<i>Juncus conglomeratus</i>	I	
<i>Juncus squarrosus</i>	I	
<i>Luzula multiflora</i>	I	
<i>Luzula sylvatica</i>	I	
<i>Nardus stricta</i>	I	
<i>Oxalis acetosella</i>	I	
<i>Polytrichum commune</i>	I	
<i>Pteridium aquilinum</i>	I	
<i>Rhytidiadelphus loreus</i>	I	
NVC Community	Most referable to H12a <i>Calluna vulgaris</i> - <i>Vaccinium myrtillus</i> heath, <i>Calluna vulgaris</i> sub-community	
Notes	Raised area close to Carter Burn, transitional with M19 <i>Calluna vulgaris</i> - <i>Eriophorum vaginatum</i> blanket mire.	

Quadrat Number	OS grid reference	
E	NT 64217 08334	
Species	Cover	
<i>Eriophorum vaginatum</i>	V	
<i>Molinia caerulea</i>	V	
<i>Calluna vulgaris</i>	IV	
<i>Polytrichum commune</i>	IV	
<i>Sphagnum fallax</i>	IV	
<i>Erica tetralix</i>	III	
<i>Pleurozium schreberi</i>	III	
<i>Sphagnum capillifolium</i>	III	
<i>Hylocomium splendens</i>	II	
<i>Sphagnum palustre</i>	II	
<i>Deschampsia cespitosa</i>	I	
<i>Juncus acutiflorus</i>	I	
<i>Juncus effusus</i>	I	
<i>Plagiothecium undulatum</i>	I	
<i>Rhytidiadelphus loreus</i>	I	
<i>Vaccinium myrtillus</i>	I	
NVC Community	M19 <i>Calluna vulgaris</i> - <i>Eriophorum vaginatum</i> blanket mire.	
Notes	Relatively homogenous ride between conifer plantation blocks, large hummocks of sphagnum.	

Quadrat Number	OS grid reference	
G	NT 64457 06892	
Species	Frequency	
<i>Dactylis glomerata</i>	V	
<i>Deschampsia cespitosa</i>	V	
<i>Angelica sylvestris</i>	IV	
<i>Cruciata laevipes</i>	IV	
<i>Juncus conglomeratus</i>	IV	
<i>Pseudoscleropodium purum</i>	IV	
<i>Rumex acetosa</i>	IV	
<i>Cardamine pratensis</i>	II	
<i>Centaurea nigra</i>	II	
<i>Holcus mollis</i>	II	
<i>Plantago lanceolata</i>	II	
<i>Ranunculus repens</i>	II	
<i>Ulex europaeus</i>	II	
<i>Urtica dioica</i>	II	
NVC Community	Most referable to MG9 <i>Holcus lanatus</i> – <i>Deschampsia cespitosa</i> grassland/ MG10 <i>Holcus lanatus</i> – <i>Juncus effusus</i> rush-pasture with some transitions to MG1 <i>Arrhenatherum elatius</i> grassland.	
Notes	Grassland with a tall sward with rank grasses, on a level area in between the more elevated degraded heath and the Black Burn.	

APPENDIX B – SPECIES LIST

The following table presents a species list for the study area. The list is not comprehensive but does include most species found within the main body of the bog, grassland, scrub, heath and woodland areas. Subjective estimates of the relative abundance of species within the study area were added to the list using a modified DAFOR scale. The DAFOR scale ranks species according to their relative abundance in a given parcel of land as follows: D – dominant, A – abundant, F – frequent, O – occasional, R – rare.

Table 8. Vascular plant species recorded from the study area in October 2024. Estimates of abundance using the DAFOR system are given for all species.

Scientific name	Abundance
Woody species	
<i>Acer pseudoplatanus</i>	O
<i>Alnus glutinosa</i>	O
<i>Betula pendula</i>	O
<i>Betula pubescens</i>	O
<i>Calluna vulgaris</i>	A
<i>Crataegus monogyna</i>	O
<i>Cytisus scoparius</i>	O
<i>Fagus sylvatica</i>	O
<i>Fraxinus excelsior</i>	O
<i>Picea sitchensis</i>	A
<i>Pinus sylvestris</i>	A
<i>Quercus robur</i>	F
<i>Quercus petraea</i>	F
<i>Rubus fruticosus agg.</i>	F
<i>Salix cinerea</i>	O
<i>Sorbus aucuparia</i>	F
<i>Ulex europaeus</i>	O
<i>Vaccinium myrtillus</i>	F
Herbaceous species	
<i>Achillea millefolium</i>	F
<i>Agrostis capillaris</i>	F
<i>Angelica sylvestris</i>	A
<i>Anthoxanthum odoratum</i>	F
<i>Anthriscus sylvestris</i>	F
<i>Avenella flexuosa</i>	F
<i>Bellis perennis</i>	O
<i>Blechnum spicant</i>	F
<i>Cardamine pratensis</i>	O
<i>Carex rostrata</i>	O
<i>Centaurea nigra</i>	O

Scientific name	Abundance
<i>Chamaenerion angustifolium</i>	F
<i>Cirsium arvense</i>	F
<i>Cirsium palustre</i>	F
<i>Cruciata laevipes</i>	F
<i>Dactylis glomerata</i>	F
<i>Deschampsia cespitosa</i>	F
<i>Digitalis purpurea</i>	F
<i>Dryopteris filix-mas</i>	O
<i>Equisetum hymale</i>	O
<i>Erica tetralix</i>	F
<i>Eriophorum vaginatum</i>	A
<i>Festuca ovina</i>	O
<i>Festuca rubra</i>	O
<i>Filipendula ulmaria</i>	A
<i>Galium aparine</i>	O
<i>Galium palsutre</i>	F
<i>Galium saxatile</i>	F
<i>Geranium robertianum</i>	O
<i>Geum rivale</i>	F
<i>Heracleum sphondylium</i>	O
<i>Holcus lanatus</i>	F
<i>Holcus mollis</i>	F
<i>Juncus acutiflorus</i>	A
<i>Juncus conglomeratus</i>	A
<i>Juncus effusus</i>	A
<i>Lathyrus pratensis</i>	F
<i>Lotus pedunculatus</i>	F
<i>Luzula multiflora</i>	O
<i>Luzula sylvatica</i>	O
<i>Molinia caerulea</i>	A
<i>Montia fontana</i>	R
<i>Nardus stricta</i>	R
<i>Oxalis acetosella</i>	R
<i>Pedicularis sylvatica</i>	R
<i>Phragmites australis</i>	A (locally abundant)
<i>Plantago lanceolata</i>	O
<i>Potentilla erecta</i>	F
<i>Potentilla sterilis</i>	R
<i>Pteridium aquilinum</i>	A
<i>Ranunculus acris</i>	A
<i>Ranunculus repens</i>	A
<i>Rumex acetosa</i>	A

Scientific name	Abundance
<i>Rumex obtusifolius</i>	R
<i>Silene flos-cuculi</i>	R
<i>Stellaria holostea</i>	F
<i>Trifolium repens</i>	F
<i>Typha latifolia</i>	A (locally abundant)
<i>Urtica dioica</i>	F
<i>Veronica chamaedrys</i>	F
<i>Viola palustris</i>	O