Viking Energy

RARE PLANTS SURVEY: VIKING WINDFARM

October 2008

EnviroCentre
Craighall Business Park
Eagle Street
Glasgow
G4 9XA

t 0141 341 5040
f 0141 341 5045
w *www.envirocentre.co.uk*
e *info@envirocentre.co.uk*

Offices
Glasgow
Belfast
Stonehaven
Daresbury

Proposal Manager Dr. Andy McMullen IEEM

Proposal Director Dr. Peter Cosgrove IEEM

Development Services

Catchment Management

Sustainability

Status : Final

Job No : 12411j
Copy No : 0
Rev. No : 00

Table of Contents

List of Tables

1. INTRODUCTION

A National Vegetation Classification survey of specified parts of the Viking Windfarm application site was undertaken by Highland Ecology during the late-Spring/early-Summer months of April to June in 2008. That survey focused on the classification and mapping of the vegetation communities located within a 100m buffer zone extending from the situation of the tracks and turbine locations (resulting in a 200m wide corridor of vegetation classification).

Although it was undertaken within the recommended timeframe, the relatively early timing of the National Vegetation Classification survey was expected to result in a potential bias towards early flowering species. It was therefore considered prudent to undertake a further survey towards the end of the summer in order to record a full species list from each of the communities or areas highlighted as potentially containing rare or threatened species in a national or regional (Shetland) context. This report contains the findings of that survey and discusses their significance.

2. METHODOLOGY

The current survey was undertaken between the 11th and 15th of August, 2008 and focused on the communities and locations listed below in Table 1 that were identified by Highland Ecology as potentially containing notable species. Each location was determined precisely using a hand-held GPS unit (Garmin e-Trex) and a visual assessment made of the extent of the target communities or features. From within the limits of each of these communities or features, a comprehensive list of all of the bryophyte and phanerogam (flowering plant) species was produced.

In the case of the M10 community in particular, small 'islands' of the surrounding (blanket bog) vegetation were occasionally present within the flushes. It was decided that the species present on these islands would be omitted from the list unless they were rooted strictly within the limits of the community or feature of interest or were notable for their rarity (although the latter circumstance did not arise in practice).

The phanerogam species found at each location are listed in the tables below with their scientific and vernacular names. Although they have been contrived as a requirement of the Wildlife and Countryside Act (1981), the vernacular names for the bryophytes are not given because they have not entered into standard usage amongst bryologists or conservationists. Otherwise, the nomenclature follows the standard floras for each group[1].

The abundance of each species is also reported in the tables below according to the semi-quantitative DAFOR scale (*i.e.* **D**ominant, **A**bundant, **F**requent, **O**ccasional and **R**are).

[1] Phanerogams: Stace, C.A. 1997 New Flora of the British Isles. Cambridge University Press.
Mosses: Smith, A.J.E. 2004 The Moss Flora of Britain and Ireland. Cambridge University Press.
Liverworts: Paton, J.A. 1999 The Liverwort Flora of the British Isles. Harley Books.

Table 1: Locations or National Vegetation Classification Communities identified during the National Vegetation Classification survey as requiring a re-visit to check for the presence notable plant species. Their label within this report, grid reference and a description are indicated.

Report Section and Label	Grid Ref. (HU)	Description
3.1 M10 and M30 flush communities	Various	M10 flushes in general. These appeared to fairly species poor but should be checked when encountered on walk-over. They are fairly frequent each occurrence is not listed separately but they are target noted. Some of the target-noted M30 flushes target noted are also worth a second look (especially those listed below).
3.2 Calcareous Grassland	41978 61507	Short-grazed, species-rich calcareous grassland (CG10a) around rocky outcrop. Area should be re-visited in August to search for potential Shetland rarities and to gather a full species list, particularly the crevices and ledges that are inaccessible to grazers.
3.3 Rock outcrops	39179 57674	Scattered rocky outcrops in close proximity to one another. *Poa alpina* may grow here and it is not previously recorded from Shetland. This should be surveyed as the sample collected could not be positively confirmed.
3.4 Borrow pit	38467 56263	There may be base enrichment here as there are M10a flushes in this area which appear to be richer than usual. *Vaccinium uliginosum* was also found here and not seen elsewhere on survey.
3.5 Flush A	41659 66215	Small, species-rich, grassy flush with putative *Trollius europaeus* just emerging so worth a check.
3.6 Flush B	42309 65953	*Potamogeton polygonifolius* flush (M30) through a large area of species-rich, flushed grassland.
3.7 Flush C	41912 66099	*Potamogeton polygonifolius* flush (M30) through blanket bog (M17a) in good condition. Flush supports a rich flora with herbs as yet too small to identify.
3.8 Flush D	41083 70932	Flushed grassland around a herb-rich spring-head
3.9 Flush E	41035 70864	Site of turbine 10 with frequent base-rich flush communities
3.10 Meadow of Fitchin	39 70	Watercourses/burns in the vicinity of the Meadow of Fitchin, some of which appeared quite rich at the time of survey.
3.11 Flush F	38524 67072	A small stand of flushed grassland on the hillside with M6c and M6b at the base of the slope and some U4 grassland, *Philonotis fontana* springs M32 and base-rich flushes M10 at the top.
3.12 Oxnabool Burn	40287 70347	Mossy bank on the burn of Oxnabool with *Fontinalis antipyretica* in the stream and *Ranunculus flammula, Callitriche stagnalis* and *Persicaria amphibia* (new hectad record for this species).

At each of the locations specific attention was paid to the possible occurrence of rare, threatened or protected species and those that are rare in a Shetland context. Those species that were considered as potentially present in the habitats and areas visited during the course of the survey are listed in Table 2 according to their local, national and international rarity.

The weather during the course of the survey was dry and bright but overcast with occasional showers and mist towards the end of the week. These were ideal conditions for the survey, in terms of visibility and comfortable operating conditions.

Table 2: List of rare or otherwise notable species locally, in the UK, or Europe that are present in Shetland[2].

Internationally Rare

Arenaria norvegica
Cochlearia officinalis subsp. *scotica*
Dactylorhiza incarnata subspp.
Euphrasia heslop-harrisonii
Euphrasia marshallii
Hieracium spp.
Rumex acetosa subsp. *hibernicus*
Taraxacum spp.

Wildlife and Countryside Act 1981

Arneria norvegica subsp. *norvegica*
Hieraceum spp.

Nationally rare. Red Data Book Species

Arenaria norvegica subsp. *norvegica*
Carex aquatilis
Cochlearia officinalis subsp. *scotica*
Eleocharis acicularis
Euphrasia frigida
Euphrasia heslop-harrisonii
Euphrasia marshallii
Euphrasia ostenfeldii
Euphrasia foulaensis
Gnaphalium sylvaticum
Hammarbya paludosa
Pilosella flagellaris subsp. *bicapitata*
Polygonum boreale
Potamogeton friesii
Potamogeton filiformis
Potamogeton praelongum
Salix lapponum
Subularia aquatica
Taraxacum spp.

Locally Rare

Alchemilla alpina
Betula pubescens subsp. *tortuosa*
Campanula rotundifolia
Chamerion angustifolium
Cornus suecica
Corylus avellana
Dactylorhiza incarnata subspp.
Drosera anglica
Empetrum hermaphroditum
Euphrasia frigida
Euphrasia heslop-harrisonii
Festuca rubra subsp. *arctica*
Festuca rubra subsp. *scotica*
Gymnadenia conopsea subsp. *borealis*
Hammarbya paludosa
Hieracium spp.
Juncus trifidus
Juncus triglumis
Juniperus communis
Loiseleuria procumbens
Luzula spicata
Melampyrum pratense subsp. *pratense*
Molinia caerulea subsp. *arundinacea*
Myriophyllum spicatum
Nymphaea alba subsp. *occidentlis*
Osmunda regalis
Phyllitis scolopendrium
Polygonum aviculare
Polypodium x mantoniae
Populus tremula
Poramogeton friesii
Potamogeton filiformis
Potamogeton rutilius
Rumex actetosa subsp. *hibernicus*
Salicornia europaea agg.
Salix cinerea subsp. cinerea
Salix lapponum
Salix x multinervis
Saussurea alpina
Sedum anglicum
Sparganium spp.
Taraxacum spp.
Trifolium dubium
Vaccinium oxycoccus

[2] Scott, W., Harvey, P., Diddlington, R. and Fisher, M. 2002 Rare plants of Shetland. Shetland Amenity Trust, Lerwick

3. RESULTS AND DISCUSSION

In this section of the report, the results of the floristic survey (a list of the species and their abundance) for each of the locations or National Vegetation Classification communities specified in Table 1 are presented. Each table lists the phanerogam species initially with the bryophyte species listed below. References to Target Notes refer to those included in the highland Ecology report on the National Vegetation Classification of the site included as an appendix with the Environmental Statement. A series of photographs were also taken and these can be provided upon request.

3.1 M10 and M30 flush communities

The greatest concentration of M10 flushes was located in Nesting but this community type is generally widespread and frequent to occasional, but localized, throughout most of the application site, with exception to the Collafirth quadrant, where only two species-poor examples were located. As a result of this frequency, a subset of target-noted M10 communities was selected, in the field, to represent the range of floristic diversity in the vicinity of each locality. The M30 community is less frequent in its occurrence and is generally confined to the margins of soakways and rills which limit its extent in relation to the larger expanses of M10.

Further observations of the floristic of the M10 and M30 communities are included in Sections 3.4, 3.5, 3.6, 3.7, 3.9 and 3.11.

3.1.1 Nesting M10 and M30 communities.

The M10 communities at Nesting were generally rather peaty with little exposure of the potentially base-rich, mineral substrate. This resulted in a greater frequency and cover of typical bog species such as common bog-cotton and bog asphodel than within the limits of the community elsewhere within the application boundary, as well as a high degree of intergradation with the M30 community type as evidenced in the high cover frequently attributable to bog pondweed.

Table 3: List of M30 species recorded at Target Note 12, Nesting.

Scientific Name	Vernacular Name	Abundance
Agrostis stolonifera	Creeping Bent	O
Calluna vulgaris	Heather	R
Carex nigra	Black Sedge	A
Carex panicea	Carnation Grass	O
Eriophorum angustifolium	Common Bog-cotton	R
Juncus articulatus	Jointed Rush	R
Juncus bulbosus	Bulbous Rush	O
Nardus stricta	Mat Grass	R
Potamogeton polygonifolius	Bog Pondweed	A
Ranunculus flammula	Lesser Spearwort	O
Sphagnum denticulatum	A moss	O

The vegetation cover within these communities was generally rather closed, especially in the case of Target Note 83, in comparison to examples elsewhere within the application boundary. Sedges are especially prominent with a typical cover of around 30% and the levels of grazing result in the frequent removal of their flowering spikes and the associated poaching, in combination with the closeness of the sward, is assumed to responsible for the low diversity and abundance of moss and liverwort species.

Table 4: List of M10 species recorded at Target Note 17, Nesting.

Scientific Name	Vernacular Name	Abundance
Carex panicea	Carnation Grass	F
Carex viridula subsp. *oedocarpa*	Yellow Sedge	A
Eriophorum angustifolium	Common Bog-cotton	R
Juncus articulatus	Jointed Rush	O
Juncus bulbosus	Bulbous Rush	O
Juncus squarrosus	Heath Rush	R
Montia fontana	Blinks	O
Nardus stricta	Mat Grass	O
Narthecium ossifragum	Bog Asphodel	R
Pinguicula vulgaris	Common Butterwort	F
Potamogeton polygonifolius	Bog Pondweed	F
Ranunculus flammula	Lesser Spearwort	O
Aneura pinguis	A liverwort	O
Blindia acuta	A moss	O
Pellia sp.	A liverwort	O
Racomitrium lanuginosum	A moss	R
Sphagnum compactum	A moss	R
Sphagnum denticulatum	A moss	F

Table 5: List of M10 species recorded at Target Note 29, Nesting.

Scientific Name	Vernacular Name	Abundance
Agrostis stolonifera	Creeping Bent	R
Carex dioica	Dioecious Sedge	O
Carex echinata	Start Sedge	R
Carex nigra	Black Sedge	O
Carex panicea	Carnation Grass	O
Carex pulicaris	Flea Sedge	O
Carex viridula subsp. Oedocarpa	Yellow Sedge	A
Danthonia decumbens	Heath Grass	R
Eleocharis palustris	Common Spike-rush	O
Eriophorum angustifolium	Common Bog-cotton	O
Festuca vivipara	Viviparous fescue	R
Juncus articulatus	Jointed Rush	F
Juncus bulbosus	Bulbous Rush	F
Nardus stricta	Mat Grass	O
Narthecium ossifragum	Bog Asphodel	R

Pinguicula vulgaris	Common Butterwort	R
Potamogeton polygonifolius	Bog Pondweed	R
Prunella vulgaris	Self-heal	R
Schoenus nigricans	Black Bog-rush	A
Selaginella selaginoides	Selaginella	R
Blindia acuta	A moss	R
Bryum pseudotriquetrum	A moss	R
Campylium stellatum	A moss	R
Scorpidium scorpioides	A moss	F
Sphagnum denticulatum	A moss	R

The M10 flush indicated by Target Note 29 is situated with 300m of the coast and this has resulted in a somewhat distinctive vegetation composition, especially the abundance of black bog-rush. It is assumed that the maritime influence is also responsible for the relatively low abundance mosses and especially, the absence of liverworts.

Table 6: List of M10 species recorded at Target Note 83, Nesting.

Scientific Name	Vernacular Name	Abundance
Carex hostiana	Tawny Sedge	R
Carex viridula subsp. *oedocarpa*	Yellow Sedge	A
Crepis capillaris	Smooth Hawksbeard	R
Drosera rotundifolia	Round-leaved Sundew	R
Eleocharis palustris	Marsh Spike-rush	A
Equisetum palustre	Marsh Horsetail	R
Eriophorum angustifolium	Common Bog-cotton	O
Juncus articulatus	Jointed Rush	R
Juncus bulbosus	Bulbous Rush	R
Molinia caerulea	Purple Moor-grass	R
Narthecium ossifragum	Bog Asphodel	R
Pinguicula vulgaris	Common Butterwort	F
Plantago maritima	Sea Plantain	R
Ranunculus flammula	Lesser Spearwort	R
Schoenus nigricans	Black Bog-rush	R
Selaginella selaginoides	Selaginella	R
Succisa pratensis	Devil's-bit Scabious	R
Trichophorum caespitosum	Deergrass	R
Aneura pinguis	A liverwort	R
Blindia acuta	A moss	O
Campylium stellatum	A moss	R
Scorpidium scorpioides	A moss	A

3.1.2 Delting M10 communities

Table 7: List of M10 species recorded at Target Notes 268 and 274, Delting.

Scientific Name	Vernacular Name	Abundance
Carex hostiana	Tawny Sedge	R
Carex viridula subsp. oedocarpa	Yellow Sedge	A
Drosera rotundifolia	Round-leaved Sundew	O
Eriophorum angustifolium	Common Bog-cotton	F
Festuca ovina	Sheep's Fescue	O
Juncus articulatus	Jointed Rush	R
Juncus squarrosus	Heath Rush	O
Nardus stricta	Mat Grass	O
Narthecium ossifragum	Bog Asphodel	R
Pinguicula vulgaris	Common Butterwort	F
Selaginella selaginoides	Selaginella	R
Aneura pinguis	A liverwort	O
Blepharostoma trichophylla	A liverwort	R
Blindia acuta	A moss	F
Campylopus introflexus	A moss	R
Nardia compressa	A liverwort	O

The M10 flushes in the vicinity of Target Notes 268 and 274 are rather species-poor in relation to examples elsewhere within the application boundary. This is presumed to a reflection of their relatively small area, both individually and cumulatively, as well as the prominence of edge effects because each occurrence is a linear drainage feature, directed downslope, and all are less than 5m wide.

A *Taraxacum* species that was not in flower, and consequently indefinitely determinable, was also recorded from blanket bog habitat in this vicinity. On the basis of leaf shape and habitat, it is assumed that this species is *T. faeroense* – a widespread and common species that is distinctive in its blanket bog habitat, leaf form and colour.

3.1.3 Kergord M10 and M30 communities

The M10 flushes indicated by target Notes 334 and 336 have developed over siliceous rock, which is exposed in places, and this has resulted in the development of a rather indistinct flora due to the low level of base-enrichment. As well as the more distinctive elements listed in Table 7 that were rooted within the exact limits of the flush areas, there are frequent small islands of blanket bog vegetation and this, in combination with the peat hagging evident in their vicinity, may indicate the relatively recent exposure of the flushed rock surfaces.

As is evident in the number of species listed in Table 8, the flush at Target Note 339 is most species-rich of the M10 communities visited during the course of the survey. This richness is assumed to relate to the large size of the flush and the availability of a variety of niches as well as the consequent ability of the distinctive species to maintain viable populations. Although the

flush is crossed by numerous sheep tracks, grazing within it appears to be limited by the openness of the vegetation. The exposure of the mineral substrate is prominent within the flush and the herb cover is less than 10%.

Table 8: List of M10 species recorded at Target Notes 334 and 336, Kergord.

Scientific Name	Vernacular Name	Abundance
Carex panicea	Carnation Grass	O
Carex viridula subsp. oedocarpa	Yellow Sedge	A
Juncus bulbosus	Bulbous Rush	F
Juncus squarrosus	Heath Rush	O
Nardus stricta	Mat Grass	F
Andreaea rupestris	A moss	O
Blindia acuta	A moss	O
Nardia scalaris	A liverwort	R
Racomitrium heterostichum	A moss	R
Racomitrium lanuginosum	A moss	O
Sphagnum denticulatum	A moss	F

The plants recorded from the M30 community indicated by Target Note 356, and listed in Table 9, are rooted in peat marginally, or within a floating mat of the moss *Sphagnum denticulatum* towards the centre of the flush. A degree of enrichment is evident in the lush appearance of the vegetation and the presence of species such as soft rush and creeping bent and the moss *Campylium stellatum*. This has been amplified further through preferential grazing by sheep and a high degree of poaching has thus taken place which has resulted in the occasional appearance of the ruderal, procumbent pearlwort. A small rill is confined to the centre of the flush and is evident in the associated abundance of bog pondweed.

Table 9: List of M30 species recorded at Target Note 356, Kergord.

Scientific Name	Vernacular Name	Abundance
Agrostis stolonifera	Creeping Bent	F
Carex panicea	Carnation Grass	R
Eriophorum angustifolium	Common Bog-cotton	R
Juncus articulatus	Jointed Rush	R
Juncus bulbosus	Bulbous Rush	A
Montia fontana	Blinks	R
Potamogeton polygonifolius	Bog Pondweed	A
Ranunculus flammula	Lesser Spearwort	F
Rumex acetosa	Sorrel	R
Trichophorum caespitosum	Deergrass	F
Polytrichum commune	A moss	O
Sphagnum denticulatum	A moss	A
Sphagnum capillifolium	A moss	R
Sphagnum palustre	A moss	O

Table 10: List of M10 species recorded at Target Note 339, Kergord.

Scientific Name	Vernacular Name	Abundance
Agrostis stolonifera	Creeping Bent	R
Cardamine pratensis	Cuckooflower	R
Carex dioica	Dioecious Sedge	R
Carex hostiana	Tawny Sedge	O
Carex panicea	Carnation Grass	O
Carex pulicaris	Flea Sedge	R
Carex viridula subsp. oedocarpa	Yellow Sedge	A
Eleocharis palustris	Marsh Spike-rush	F
Equisetum palustre	Marsh Horsetail	R
Eriophorum angustifolium	Common Bog-cotton	R
Euphrasia scotica	Eyebright	R
Juncus articulatus	Jointed Rush	O
Juncus bulbosus	Bulbous Rush	O
Juncus effusus	Soft Rush	R
Pinguicula vulgaris	Common Butterwort	O
Potamogeton polygonifolius	Bog Pondweed	R
Prunella vulgaris	Self-heal	O
Ranunculus flammula	Lesser Spearwort	R
Rumex acetosella	Sheep's Sorrel	R
Sagina procumbens	Procumbent Pearlwort	O
Selaginella selaginoides	Selaginella	R
Thalictrum alpinum	Alpine Meadow-rue	R
Aneura pinguis	A liverwort	R
Blindia acuta	A moss	F
Bryum pseudotriquetrum	A moss	F
Calliergonella cuspidata	A moss	O
Campylium stellatum	A moss	F
Campylopus atrovirens	A moss	O
Ctenidium molluscum	A moss	O
Dicranum fuscescens	A moss	R
Drepanocladus revolvens	A moss	O
Hypnum cupressiforme	A moss	O
Racomitrium lanuginosum	A moss	R
Scorpidium scorpioides	A moss	A

3.2 Calcareous grassland

This grassland area has developed over an outcrop of limestone within a landscape otherwise dominated by more acid geology. The result is a distinctive area of lush growth which is clearly visible from the road, over a kilometre away, that has been grazed intensively by sheep to produce a low, tightly-cropped sward. The flora is equally distinctive and very diverse, in a local context, with niches available in the sward and upon the outcrops of limestone, especially within or upon sheltered fissures or faces.

A total of seventy-five species was recorded from the limits of this limestone area whose wider influence is limited by the acidity of the surrounding drift and blanket peat. Accordingly, the flushes below the outcrop do not reflect its presence and are dominated by typical blanket bog species.

Despite the diversity and distinctiveness of the flora here only one, potential rare or otherwise notable taxon was encountered – a species of *Taraxacum*. The identity of this (micro-)species was indeterminable in the absence of flowering parts (that had presumably been grazed) and the poaching and nutrient enrichment that increases the number of potential *Taraxacum* species.

Table 11: List of species recorded from the calcareous grassland and rock outcrops.

Scientific Name	Vernacular Name	Abundance
Achillea millefolium	Yarrow	O
Agrostis capillaris	Soft Bent	F
Agrostis stolonifera	Creeping Bent	O
Aira praecox	Early Hair-grass	O
Alchemilla glabra	Lady's Mantle	R
Anthoxanthum odoratum	Sweet Vernal Grass	F
Armeria maritima	Thrift	R
Asplenium trichomanes	Maiden–hair Spleenwort	F
Bellis perennis	Daisy	O
Calluna vulgaris	Heather	O
Cardamine pratensis	Cuckooflower	O
Carex panicea	Carnation Grass	F
Carex pulicaris	Flea Sedge	F
Cerastium fontanum	Common Mouse-ear	R
Cirsium vulgare	Spear Thistle	O
Crepis capillaris	Smooth Hawksbeard	R
Danthonia decumbens	Heath Grass	R
Deschampsia flexuosa	Wavy Hair-grass	O
Euphrasia confusa	Eyebright	F
Festuca ovina	Sheep's Fescue	R
Galium saxatile	Heath Bedstraw	R
Holcus lanatus	Yorkshire Fog	O
Juncus squarrosus	Heath Rush	R
Linum catharticum	Purging Flax	O
Lotus corniculatus	Bird's-foot Trefoil	R
Plantago major	Rat's-tail Plantain	F
Plantago maritima	Sea Plantain	A
Poa annua	Annual Meadow-grass	R
Poa compressa	Compressed Meadow-grass	O
Poa pratensis	Smooth Meadow-grass	O
Potentilla erecta	Tormentil	R

Prunella vulgaris	Self Heal	F
Ranunculus acris	Meadow Buttercup	O
Sagina procumbens	Procumbent Pearlwort	R
Selaginella selaginoides	Selaginella	O
Sibbaldia procumbens	Sibbaldia	O
Taraxacum officinale agg.	Dandelion (not in flower)	R
Thalictrum alpinum	Alpine Meadow-rue	O
Thymus drucei	Wild Thyme	F
Trifolium repens	White Clover	O
Viola palustris	Marsh Violet	O
Viola canina	Heath Dog Violet	R
Andreaea rupestris	A moss	R
Barbula unguiculata	A moss	O
Amphidium mougeotii	A moss	F
Aneura pinguis	A liverwort	R
Anoectangium aestivum	A moss	R
Bryum argenteum	A moss	R
Bryum capillare	A moss	O
Bryum pallens	A moss	R
Bryum sp.	A moss	R
Campylium stellatum	A moss	O
Ceratodon purpureus	A moss	O
Ctenidium molluscum	A moss	F
Distichium capillaceum	A moss	O
Frullania tamarisci	A liverwort	R
Grimmia funalis	A moss	O
Homalothecium sericeum	A moss	R
Hypnum cupressiforme	A moss	F
Isothecium myosuroides	A moss	R
Mnium hornum	A moss	O
Pellia sp.	A liverwort	R
Plagiochila porelloides	A liverwort	R
Plagiomnium elatum	A moss	R
Plagiomnium undulatum	A moss	O
Plagiothecium denticulatum	A moss	R
Pogonatum aloides	A moss	R
Pogonatum urnigerinum	A moss	R
Pohlia wahlenbergii	A moss	R
Preissia quadrata	A liverwort	R
Racomitrium lanuginosum	A moss	O
Rhytidiadelphus squarrosus	A moss	O
Scleropodium purum	A moss	O
Thuidium tamariscinum	A moss	O
Tortella tortuosa	A moss	F

3.3 Rock outcrops

These rock outcrops are situated within an area of heavily-grazed U6 grassland that is enriched by the mineral material eroded from the outcrops. The inaccessible crevices and faces provide a refuge for the more grazing-sensitive species as well as a small number of those that are generally restricted to such outcrops, such as the filmy fern and the *Racomitrium* moss species.

The vegetation contains some elements of high altitude vegetation – most obviously in the abundance of least willow, and the occasional presence of northern blueberry, but the putative alpine meadow-grass, a relatively distinct species when in 'flower' was not located despite a specific search. Despite these high-altitude elements, the occasional appearance of the grazing sensitive, greater woodrush suggests the past presence of woodland.

Some elements of the M10 flush community were also present in a species-poor stand that dissects the north-western edge of the lowest outcrop that is in greatest proximity to the windfarm infrastructure. Yellow sedge and the moss *Scorpidium scorpioides* were the predominant and most distinctive species within the limits of this community.

Table 12: List of species located on the rock outcrops.

Scientific Name	Vernacular Name	Abundance
Agrostis stolonifera	Creeping Bent	O
Anthoxanthum odoratum	Sweet vernal Grass	F
Carex echinata	Star Sedge	O
Carex panicea	Carnation Grass	O
Carex viridula subsp. oedocarpa	Yellow Sedge	A
Deschampsia flexuosa	Wavy Hair-grass	O
Dryopteris dilatata	Broad Buckler Fern	R
Empetrum nigrum	Crowberry	R
Euphrasia scotica	Eyebright	O
Festuca ovina	Sheep's Fescue	R
Festuca vivipara	Viviparous fescue	R
Galium saxatile	Heath Bedstraw	O
Huperzia selago	Fir Clubmoss	F
Hymenophyllum wilsonii	Wilson's Filmy Fern	R
Juncus articulatus	Jointed Rush	R
Juncus bulbosus	Bulbous Rush	R
Juncus squarrosus	Heath Rush	R
Luzula multiflora	Heath Woodrush	R
Luzula sylvatica	Greater Woodrush	R
Nardus stricta	Mat Grass	O
Narthecium ossifragum	Bog Asphodel	R
Pinguicula vulgaris	Common Butterwort	F
Polypodium vulgare	Polypodium	O
Potentilla erecta	Tormentil	R
Salix herbacea	Least Willow	F
Selaginella selaginoides	Selaginella	R

Thalictrum alpinum	Alpine Meadow-rue	R
Trichophorum caespitosum	Deer Grass	R
Vaccinium myrtillus	Blaeberry	O
Vaccinium uliginosum	Northern Blaeberry	R
Viola canina	Heath Dog-violet	R
Amphidium mougeotii	A moss	R
Andreaea rupestris	A moss	R
Anoectangium aestivum	A moss	R
Aneura pinguis	A liverwort	R
Barbilophozia floerkei	A liverwort	O
Bryum pseudotriquetrum	A moss	R
Campylopus paradoxus	A moss	R
Ctenidium molluscum	A moss	R
Dicranum scoparium	A moss	F
Diplophyllum albicans	A liverwort	O
Hypnum cupressiforme	A moss	O
Isothecium myosuroides	A moss	O
Lophozia ventricosa	A liverwort	F
Marsupella emarginata	A liverwort	R
Mnium hornum	A moss	O
Mylia taylorii	A liverwort	O
Nardia scalaris	A liverwort	F
Palustriella commutata	A moss	R
Pellia sp.	A liverwort	R
Polytrichum commune	A moss	F
Polytrichum juniperinum	A moss	F
Racomitrium aciculare	A moss	R
Racomitrium heterostichum	A moss	F
Racomitrium lanuginosum	A moss	A
Rhytidiadelphus loreus	A moss	O
Scapania gracilis	A liverwort	R
Scapania dentata	A liverwort	R
Scorpidium scorpioides	A moss	R

3.4 Borrow pit area

This area is distinct in the presence of a flushed grassland within an area otherwise dominated by heather-dominated heath on the slopes leading to blanket bog on the more level ground below. A certain degree of base-enrichment is evident in the occurrence and frequency of the mosses *Campylium stellatum*, *Ctendidum molluscum* and *Tortella tortuosa*. Phanerogams indicative of base-rich conditions are restricted by the intensive and preferential grazing that occurs here although the diminutive alpine meadow-rue persists under the cover of encroaching heather shrubs. This grazing has also resulted in localised puddling and nutrient enrichment and in the localised presence of ruderal species such as common mouse-ear and procumbent pearlwort.

Scientific Name	Vernacular Name	Abundance
Agrostis capillaris	Soft Bent	A
Agrostis stolonifera	Creeping Bent	F
Anthoxanthum odoratum	Sweet Vernal Grass	F
Calluna vulgaris	Heather	F
Carex dioica	Dioecious Sedge	O
Carex echinata	Start Sedge	O
Carex panicea	Carnation Grass	F
Carex viridula subsp. *oedocarpa*	Yellow Sedge	F
Cerastium fontanum	Common Mouse-ear	O
Crepis capillaris	Smooth Hawksbeard	O
Danthonia decumbens	Heath Grass	R
Euphrasia confusa	Eyebright	F
Festuca ovina	Sheep's Fescue	F
Festuca rubra	RedFescue	A
Festuca vivipara	Viviparous Fescue	R
Juncus effusus	Soft Rush	R
Juncus squarrosus	Heath Rush	F
Luzula sylvatica	Greeater Woodrush	R
Luzula multiflorum	Heath Woodrush	O
Nardus stricta	Mat Grass	F
Plantago lanceolata	Ribwort Plantain	F
Plantago maritima	Sea Plantain	O
Potentilla erecta	Tormentil	O
Prunella vulgaris	Self Heal	F
Selaginella selaginoides	Selaginella	O
Sibbaldia procumbens	Procumbent Pearlwort	O
Taraxacum officinale agg.	Dandelion	R
Thalictrum alpinum	Alpine Meadow-rue	F
Viola palustris	Marsh Violet	O
Viola canina	Heath Dog Violet	R
Bryum pseudotriquetrum	A moss	O
Calliergonella cuspidata	A moss	O
Campylium stellatum	A moss	O
Ctenidium molluscum	A moss	F
Dicranum fuscescens	A moss	O
Dicranum scoparium	A moss	F
Hylocomium splendens	A moss	A
Hypnum cupressiforme	A moss	O
Isothecium myosuroides	A moss	O
Mnium hornum	A moss	F
Plagiothecium undulatum	A moss	R
Polytrichum juniperinum	A moss	O
Racomitrium heterostichum	A moss	F
Racomitrium lanuginosum	A moss	F
Scleropodium purum	A moss	O
Thuidium tamariscinum	A moss	O
Tortella tortuosa	A moss	O

3.5 Flush A

Table 13: Species recorded from Flush A.

Scientific Name	Vernacular Name	Abundance
Anthoxanthum odoratum	Sweet vernal Grass	R
Bellis perennis	Daisy	R
Carex dioica	Dioecious Sedge	F
Carex flacca	Glaucous Sedge	R
Carex hostiana	Tawny Sedge	O
Carex nigra	Black Sedge	F
Carex panicea	Carnation Grass	O
Carex viridula subsp. oedocarpa	Yellow Sedge	O
Cirsium palustre	Marsh Thistle	R
Epilobium palustre	Marsh Willowherb	R
Equisetum palustre	Marsh Horsetail	R
Eriophorum angustifolium	Common Bog-cotton	R
Euphrasia scotica	Eyebright	R
Festuca vivipara	Viviparous Fescue	R
Holcus lanatus	Yorkshire Fog	R
Juncus articulatus	Jointed Rush	A
Nardus stricta	Mat Grass	O
Narthecium ossifragum	Bog Asphodel	R
Pinguicula vulgaris	Common Butterwort	R
Plantago lanceolata	Ribwort Plantain	R
Plantago maritima	Sea Plantain	R
Potamogeton polygonifolius	Bog Pondweed	R
Potentilla erecta	Tormentil	R
Ranunculus flammula	Lesser Spearwort	R
Sagina procumbens	Procumbent Pearlwort	R
Schoenus nigricans	Black Bog-rush	O
Succisa pratensis	Devil's-bit Scabious	R
Thalictrum alpinum	Alpine Meadow-rue	O
Trichophorum caespitosum	Deergrass	R
Blindia acuta	A moss	F
Bryum pseudotriquetrum	A moss	O
Campylium stellatum	A moss	O
Campylopus atrovirens	A moss	R
Campylopus introflexus	A moss	R
Dicranum scoparium	A moss	R
Hylocomium splendens	A moss	R
Pellia sp.	A liverwort	O
Racomitrium aciculare	A moss	R
Scorpidium scorpioides	A moss	F

This species-rich flush is located within a complex of flushes that all approximate to M10 although elements of the M6 community become apparent within the stands where some peat development has occurred. The species list in Table 12 below was collated from the species-

rich flush located at HU 41659 66245 and the flora of the remaining flushes is derived from this list but with greater representation of less-distinctive, moorland species.

The primary reason for visiting this flush was to determine the possible presence of globeflower (*Trollius europeas*) but this could not be located here or in the wider area. This does not preclude its presence because sheep graze these slopes and it may have fallen prey to their activity. Otherwise, the flora of this flush in particular is relatively rich and distinctive from that in the surrounding vegetation types. The surrounding flushes are less distinctive and intergrade with the vegetation of the surrounding grassland and heath vegetation.

3.6 Flush B

This flush flows through a limited area of relatively species-rich grassland, in the bottom of a peat hag, which has been grazed intensively to produce a short, tightly-cropped sward. The flush, which is referable to M30, is dominated by bog pondweed along the course of the water flow and by a marginal, floating raft of the bog moss *Sphagnum denticulatum*. The main diversity of flowering species, as listed in Table 13, within the flush whereas the adjacent grassland is dominated by creeping bent with occasional stands of Yorkshire fog. The stonewort, *Nitella flexilis*, is located in the water channel upstream of flush community.

Table 14: Species recorded from Flush B.

Scientific Name	Vernacular Name	Abundance
Agrostis stolonifera	Creeping Bent	A
Caltha palustris	Marsh Marigold	A
Cardamine pratensis	Cuckooflower	F
Carex nigra	Black Sedge	F
Epilobium palustre	Marsh Willowherb	R
Equisetum fluviatile	Marsh Horsetail	F
Holcus lanatus	Yorkshire Fog	F
Juncus articulatus	Articulated Rush	A
Juncus bulbosus	Bulbous Rush	A
Myosotis secunda	Creeping Forget-me-not	F
Ranunculus flammula	Lesser Spearwort	A
Stellaria uliginosa	Bog Stitchwort	A
Nitella flexilis var. flexilis	Stonewort	O
Sphagnum denticulatum	A bog moss	A

3.7 Flush C

This flush is situated with an area of blanket bog in good condition and was noted for its apparent diversity during the National Vegetation Classification survey when the constituent herbs were too small to identify. The current survey identified these herbs in a mature condition and they are listed below in Table 14.

The open water is dominated by the bog mosses *Sphagnum cuspidatum* and *S. denticulatum* with marginal stands of bottle sedge. Where the ground is more consolidated, a limited range and low cover of herbs is present within a relatively dominant and diverse lawn of mosses.

Grazing is relatively light in this area and this is presumed to be a combination of the wet, infirm ground conditions and the scarcity of palatable species.

Table 15: Species recorded from Flush C.

Scientific Name	Vernacular Name	Abundance
Agrostis stolonifera	Creeping Bent	O
Caltha palustris	Marsh Marigold	O
Cardamine palustris	Cuckooflower	O
Carex echinata	Star Sedge	O
Carex nigra	Black Sedge	F
Carex rostrata	Bottle Sedge	O
Galium palustre	Marsh Bedstraw	O
Juncus articulatus	Articulated Rush	F
Juncus bulbosus	Bulbous Rush	F
Nardus stricta	Mat Grass	O
Potentilla erecta	Tormentil	O
Ranunculus flammula	Lesser Spearwort	F
Trichophorum caespitosum	Deergrass	O
Triglochin palustris	Marsh Arrow-grass	O
Aulacomnium palustre	A moss	O
Mnium hornum	A moss	R
Philonotis fontana	A moss	F to A
Sphagnum cuspidatum	A moss	O
Sphagnum denticulatum	A moss	A
Warnstorfia exannulata	A moss	O

3.8 Flush D and associated grassland

The area of flushed grassland is situated around a springhead marked by a large mound of the moss *Philonotos fontana*. As is typical for the area, the enrichment of the grassland by the flush attracts intensive grazing and the production of a closed sward and the poaching and nutrient enrichment permits the persistence of the 'weed' species procumbent pearlwort. Otherwise, species of bent and fescue are predominant with significant stands of soft rush.

The open channel is marked by elements of the M30 flush community and some indication of base-enrichment is apparent in the presence of yellow sedge. This community is however dominated by bog pondweed as well as a relatively diverse assemblage of common moss and liverwort species.

Table 16: Species recorded from Flush D.

Scientific Name	Vernacular Name	Abundance
Anthoxanthum odoratum	Sweet vernal Grass	R
Callitriche stagnalis	Common Water-starwort	A
Cardamine pratensis	Cuckooflower	O
Carex viridula subsp. oedocarpa	Yellow Sedge	O
Galium palustre	Marsh Bedstraw	O
Juncus bulbosus	Bulbous Rush	F
Juncus effusus	Soft Rush	O
Potamogeton polygonifolius	Bog Pondweed	R
Ranunculus flammula	Lesser Spearwort	R
Rumex acetosa	Sorrel	R
Sagina procumbens	Procumbent Pearlwort	O
Viola palustris	Marsh Violet	R
Calliergonella cuspidata	A moss	R
Drepanocladus fluitans	A moss	O
Drepanocladus revolvens	A liverwort	R
Pellia sp.	A liverwort	O
Philonotis fontana	A moss	O
Polytrichum commune	A moss	O
Polytrichum juniperinum	A moss	O
Rhytidiadelphus squarrosus	A moss	R
Scapania dentata	A liverwort	R
Sphagnum capillifolium	A moss	R
Sphagnum denticulatum	A moss	A

Table 17: Species recorded from the grassland associated with Flush D.

Scientific Name	Vernacular Name	Abundance
Agrostis capillaris	Soft Bent	F
Agrostis stolonifera	Creeping Bent	O
Carex nigra	Black Sedge	R
Carex panicea	Carnation Grass	O
Deschampsia flexuosa	Wavy Hair-grass	O
Festuca ovina	Sheep's Fescue	O
Festuca rubra	Red Fescue	O
Festuca vivipara	Viviparous fescue	R
Galium palustre	Marsh Bedstraw	O
Juncus effusus	Soft Rush	A
Juncus squarrosus	Heath Rush	F
Poa humilis	Spreading Meadow-grass	R
Potentilla erecta	Tormentil	F
Viola palustris	Marsh Violet	O

Aulacomnium palustre	A moss	O
Dicranum scoparium	A moss	R
Hypnum jutlandicum	A moss	O
Mnium hornum	A moss	R
Polytrichum commune	A moss	O
Polytrichum juniperinum	A moss	O
Sphagnum papillosum	A moss	O
Rhytidiadelphus squarrosus	A moss	R
Hylocomium splendens	A moss	R
Sphagnum capillifolium	A moss	R

3.9 Flush E

This area around the situation of Turbine 10 shows evidence of base-enrichment and the vegetation composition is comparable to the flora described above for Flush D except for the very heavy grazing pressure here that has reduced the diversity and the abundance of the distinctive species significantly.

Table 18: Species recorded from Flush E.

Scientific Name	Vernacular Name	Abundance
Anthoxanthum odoratum	Sweet vernal Grass	R
Cardamine pratensis	Cuckooflower	R
Carex panacea	Carnation Grass	R
Carex viridula subsp. oedocarpa	Yellow Sedge	R
Galium palustre	Marsh Bedstraw	O
Ranunculus flammula	Lesser Spearwort	R
Rumex acetosa	Sorrel	R
Sagina procumbens	Procumbent Pearlwort	O
Viola palustris	Marsh Violet	R
Pellia sp.	A liverwort	R
Philonotis fontana	A moss	O
Polytrichum juniperinum	A moss	O
Rhytidiadelphus squarrosus	A moss	O
Sphagnum denticulatum	A moss	A

3.10 Meadow of Fitchen

Two discrete habitats, distinguished from the adjacent blanket bog habitat, were investigated in the vicinity of the Meadow of Fitchen: the banks of the burn (which are composed of eroded peat faces and minor outcrops of bedrock and boulders) and the adjacent, rush-dominated, alluvial margins. The former habitat is typified by a low diversity of phanerogams, partly due to the instability of the banks and the poor substrate afforded by the smooth exposures of rock. The bryophyte flora is only slightly more diverse and dominated by ruderal species able to rapidly and repeatedly recolonise fresh peat and mineral exposures as well as a limited number

of more strictly riparian species (such as *Jungermannia atrovirens*, *Racomitrium aciculare* and *Scapania undulata*).

The rush-dominated, riparian areas at the Meadow of Fitchin are heavily grazed and poached and dominated by stands of the unpalatable soft rush. Between the stands of soft rush, the vegetation is limited to a narrow range of phanerogam associates with a relatively diverse assemblage of moss and liverwort species in areas that are grazed but not subject to severe trampling.

Table 19: Riparian species recorded from the Meadow of Fitchin.

Scientific Name	Vernacular Name	Abundance
Blechnum spicant	Hard Fern	R
Callitriche hamulata	Intermediate Water-starwort	R
Callitriche stagnalis	Common Water-starwort	O
Cardamine pratensis	Cuckooflower	R
Galium saxatile	Heath Bedstraw	R
Juncus articulatus	Jointed Rush	O
Juncus bulbosus	Bulbous Rush	F
Juncus effusus	Soft Rush	R
Potamogeton polygonifolius	Bog Pondweed	R
Ranunculus flammula	Lesser Spearwort	O
Sagina procumbens	Procumbent Pearlwort	O
Viola palustris	Marsh Violet	O
Batrachospermum gelatinosum	Frogspawn Algae	O
Blindia acuta	A moss	F
Dicranella heteromalla	A moss	F
Dicranella palustris	A moss	R
Diplophyllum albicans	A liverwort	O
Draparnaldia	An alga	R
Fontinalis antipyretica	A moss	F
Jungermannia atrovirens	A liverwort	R
Lophozia ventricosa	A liverwort	O
Mnium hornum	A moss	O
Pellia sp.	A liverwort	F
Pogonatum aloides	A moss	F
Polytrichum commune	A moss	O
Racomitrium aciculare	A moss	R
Racomitrium heterostichum	A moss	R
Scapania dentata	A liverwort	O

Table 20: Species recorded from rush-dominated riparian areas in the Meadow of Fitchin.

Scientific Name	Vernacular Name	Abundance
Agrostis capillaris	Soft Bent	A
Agrostis stolonifera	Creeping Bent	A
Cardamine pratensis	Cuckooflower	F
Carex nigra	Black Sedge	O
Epilobium palustre	Marsh Willowherb	O
Holcus lanatus	Yorkshire Fog	F
Juncus articulatus	Jointed Rush	O
Juncus effusus	Soft Rush	D
Ranunculus acris	Meadow Buttercup	O
Ranunculus flammula	Lesser Spearwort	O
Rumex acetosella	Sheep's Sorrel	F
Sagina procumbens	Procumbent Pearlwort	O
Calliergonella cuspidata	A moss	F
Drepanocladus fluitans	A moss	F
Drepanocladus revolvens	A moss	R
Pellia sp.	A liverwort	R
Polytrichum commune	A moss	O
Rhizomnium punctatum	A moss	R
Sphagnum denticulatum	A moss	O
Sphagnum mucronatum	A moss	O
Sphagnum palustre	A moss	O
Sphagnum papillosum	A moss	F

3.11 Flush F

Table 21: Species recorded from Flush F.

Scientific Name	Vernacular Name	Abundance
Callitriche stagnalis	Common Water-starwort	O
Cardamine pratensis	Cuckooflower	O
Carex panicea	Carnation Grass	F
Cerastium fontanum	Common Mouse-ear	R
Juncus bulbosus	Bulbous Rush	F
Montia fontana	Blinks	O
Ranunculus flammula	Lesser Spearwort	F
Sagina procumbens	Procumbent Pearlwort	R
Viola palustris	Marsh Violet	F
Aulacomnium palustre	A moss	R
Barbilophozia hatcheri	A liverwort	R
Calliergonella cuspidata	A moss	D
Philonotis fontana	A moss	O
Sphagnum compactum	A moss	R
Sphagnum palustre	A moss	R

The species list for this location was recorded from the flush itself and the flushed grassland area down-slope. The whole area is subject to intensive grazing which has resulted in the

creation of a short, close-cropped sward within an area otherwise dominated by blanket bog and heath communities, with small areas of erosion where sheep have gathered.

Table 22: Species recorded from the grassland associated with Flush F.

Scientific Name	Vernacular Name	Abundance
Agrostis stolonifera	Creeping Bent	F
Agrostis capillaris	Soft Bent	A
Aira praecox	Early Hair-grass	F
Anthoxanthum odoratum	Sweet vernal Grass	F
Calluna vulgaris	Heather	A
Cardamine pratensis	Cuckooflower	O
Carex panicea	Carnation Grass	F
Cerastium fontanum	Common Mouse-ear	O
Empetrum nigrum	Crowberry	O
Euphrasia confusa	Eyebright	F
Euphrasia scotica	Eyebright	O
Festuca ovina	Sheep's Fescue	A
Festuca rubra	Red Fescue	F
Festuca vivipara	Viviparous Fescue	O
Huperzia selago	Fir Clubmoss	R
Juncus bulbosus	Bulbous Rush	O
Juncus effusus	Soft Rush	A
Potentilla erecta	Tormentil	F
Prunella vulgaris	Self-heal	O
Ranunculus acris	Meadow Buttercup	O
Sibbaldia procumbens	Procumbent Pearlwort	F
Aulacomnium palustre	A moss	F
Calliergonella cuspidata	A moss	F
Climacium dendroides	A moss	R
Dicranum fuscescens	A moss	F
Dicranum scoparium	A moss	O
Fissidens adianthoides	A moss	O
Hylocomium splendens	A moss	F
Mnium hornum	A moss	F
Pellia sp.	A liverwort	O
Polytrichum commune	A moss	F
Polytrichum juniperinum	A moss	F
Sphagnum palustre	A bog moss	F

3.12 Oxnabool Burn

Two areas of habitat were investigated at this location on the Oxnabool Burn – the vegetation of a flushed slope above the burn and the species established in the riparian zone, on rocks subject to periodic or permanent submergence. *Persicaria amphibia* had been recorded from here but could not be located during the current survey and may have been grazed during the intervening period. However, the intensity of grazing in this area is relatively low.

Table 23 Flush vegetation on the bank above Oxnabool Burn.

Scientific Name	Vernacular Name	Abundance
Agrostis capillaris	Soft Bent	R
Agrostis stolonifera	Creeping Bent	O
Anthoxanthum odoratum	Sweet vernal Grass	O
Calluna vulgaris	Heather	A
Deschampsia flexuosa	Wavy Hair-grass	A
Empetrum nigrum	Crowberry	R
Eriophorum angustifolium	Common Bog-cotton	F
Festuca vivipara	Viviparous fescue	R
Juncus articulatus	Jointed Rush	R
Juncus effusus	Soft Rush	O
Juncus squarrosus	Heath Rush	O
Nardus stricta	Mat Grass	O
Potentilla erecta	Tormentil	F
Viola palustris	Marsh Violet	R
Dicranum scoparium	A moss	R
Polytrichum commune	A moss	O
Polytrichum juniperinum	A moss	O
Sphagnum palustre	A moss	A
Sphagnum papillosum	A moss	O

Table 24: Riparian and semi-/aquatic vegetation in the Oxnabool Burn.

Scientific Name	Vernacular Name	Abundance
Anthoxanthum odoratum	Sweet vernal Grass	R
Callitriche stagnalis	Common Water-starwort	F
Juncus articulatus	Jointed Rush	F
Juncus bulbosus	Bulbous Rush	F
Juncus squarrosus	Heath Rush	R
Luzula multiflora	Heath Woodrush	R
Ranunculus flammula	Lesser Spearwort	O
Sagina procumbens	Procumbent Pearlwort	A
Chiloscyphus polyanthus	A liverwort	D
Diplophyllum albicans	A liverwort	O
Drepanocladus fluitans	A moss	O
Fontinalis antipyretica	A moss	A
Jungermannia atrovirens	A liverwort	R
Pellia sp.	A liverwort	R
Rhabdoweisia crispa	A moss	R
Scapania dentata	A liverwort	F
Sphagnum denticulatum	A moss	R

4. DISCUSSION

A total of ninety-one flowering plants and eighty-five algae, moss and liverwort species was recorded during the current survey from the locations and communities highlighted during the National Vegetation Classification survey. None of these species are included amongst those in the list of rare or otherwise notable species in Shetland, in Table 2, with exception to one taxon: *Taraxacum*. Two (micro-)species attributable to this genus were located. Although both populations were indeterminate on account of the absence of flowering parts, one has been assumed to be a widespread and common taxon (*T. faeroense*), although the other is indeterminate.

No other notable species or taxa (in a local, national or international context) were encountered during the survey and the species in each location were generally found to be common and widespread.

A small proportion of weed species (especially *Cerastium fontanum* and *Sibbaldia procumbens*) was recorded from each habitat and this reflects the intensive grazing that takes place in the area. This and the related puddling of the ground create small patches amenable to the persistence of annual species and also results in the probable loss of diversity, especially amongst the tall herbs, sub-/shrubs and trees. This grazing is intensive to moderate over most of the site and it is known to be a major factor in the composition of the vegetation in Shetland.

The floristic composition of the calcareous grassland (Section 3.2) is the most diverse and distinctive, and it also contained the greatest proportion of locally uncommon species. Most of these 'local rarities' are specific to calcareous rocks and soil within an area otherwise dominated by acid bedrock and drift deposits. The less basic rock-outcrops (Section 3.3) are almost equally diverse but contain a large proportion of species derived from the adjacent, acid grassland, heath and bog habitats which resulted in the derivation of a much less-distinctive list of species.

The flush communities were generally distinctive in terms of their physiognomy as well as their floristics. The M30 communities are generally rather species-poor and dominated by bog pondweed (*Potamogeton polygonifolius*) and the bog moss *Sphagnum denticulatum* with occasional to frequent occurrences of a limited range of associates (see Table 3 and Table 9 for examples), many of which are derived from adjacent blanket bog and heath habitat.

In contrast, the M10 communities are very distinctive in terms of their physiognomy and their floristics. They are typically distinct for the exposure of open, gravely substrate, although at times, this may include a considerable proportion of peat which results in the increased presence of common blanket bog species. Where the substrate is more base-rich and mineral in composition, the vegetation is dominated by an open sward of sedges, typically with variable extents of the moss *Scorpidium scorpioides*.

As a consequence of the above findings and those of the earlier National Vegetation Classification survey, it may be assumed that there are no rare or otherwise notable species within the habitats and locations directly influenced by the windfarm and its infrastructure.

The most notable location, in terms of its species composition and limited extent, is the area of limestone outcrop (Section 3.2) which is outside of the footprint of the development and this is also the case for the more acidic rock outcrop vegetation (described in Section 3.3). In both of these cases, the potential for direct or indirect impacts to arise is further reduced by their upstanding and water-shedding nature. The current plans for the windfarm development therefore offer no threat to these areas and this can be confirmed during the construction phase by micro-siting according to the direction of the Ecological Clerk of Works.

Other areas of habitat, such as the M10 and M30 flushes although less distinctive and/or diverse in their floristic composition are still valuable habitats that can contain species that are uncommon locally (such as a range of sedges, black bog-rush or water forget-me-not). These flushes are widespread and especially frequent in the south of the application site, and should be avoided where possible by micro-siting according to the direction of the Ecological Clerk of Works.

5. CONCLUSIONS

No rare or otherwise notable plant species were recorded during the survey.

The most distinctive flora, in the vicinity of the limestone outcrop is outside the direct development footprint and naturally robust to any changes in drainage. This is also the case for the less distinctive flora of the rock outcrops.

The flush areas contain a number of species that are restricted in their distribution locally and these flushes, especially those attributable to the NVC community M10, should be avoided by micro-siting where possible.

APPENDIX A

List of all species recorded from the locations and NVC communities described above

Phanerogams

Achillea millefolium	Yarrow
Agrostis capillaris	Soft Bent
Agrostis stolonifera	Creeping Bent
Aira praecox	Early Hair-grass
Alchemilla glabra	Lady's Mantle
Anthoxanthum odoratum	Sweet Vernal Grass
Armeria maritima	Thrift
Asplenium trichomanes	Maiden–hair Spleenwort
Bellis perennis	Daisy
Blechnum spicant	Hard Fern
Callitriche hamulata	Intermediate Water-starwort
Callitriche stagnalis	Common Water-starwort
Calluna vulgaris	Heather
Caltha palustris	Marsh Marigold
Cardamine pratensis	Cuckooflower
Carex dioica	Dioecious Sedge
Carex echinata	Star Sedge
Carex flacca	Glaucous Sedge
Carex hostiana	Tawny Sedge
Carex nigra	Black Sedge
Carex panicea	Carnation Grass
Carex pulicaris	Flea Sedge
Carex rostrata	Bottle Sedge
Carex viridula subsp. oedocarpa	Yellow Sedge
Cerastium fontanum	Common Mouse-ear
Cirsium vulgare	Spear Thistle
Crepis capillaris	Smooth Hawksbeard
Danthonia decumbens	Heath Grass
Deschampsia flexuosa	Wavy Hair-grass
Drosera rotundifolia	Round-leaved Sundew
Dryopteris dilatata	Broad Buckler Fern
Eleocharis palustris	Common Spike-rush
Empetrum nigrum	Crowberry
Epilobium palustre	Marsh Willowherb
Equisetum palustre	Marsh Horsetail
Eriophorum angustifolium	Common Bog-cotton
Euphrasia confusa	Eyebright
Euphrasia scotica	Eyebright
Festuca ovina	Sheep's Fescue
Festuca rubra	Red Fescue
Festuca vivipara	Viviparous Fescue
Galium palustre	Marsh Bedstraw
Galium saxatile	Heath Bedstraw

Holcus lanatus	Yorkshire Fog
Huperzia selago	Fir Clubmoss
Hymenophyllum wilsonii	Wilson's Filmy Fern
Juncus articulatus	Jointed Rush
Juncus bulbosus	Bulbous Rush
Juncus effusus	Soft Rush
Juncus squarrosus	Heath Rush
Linum catharticum	Purging Flax
Lotus corniculatus	Bird's-foot Trefoil
Luzula multiflora	Heath Woodrush
Luzula sylvatica	Greeater Woodrush
Molinia caerulea	Purple Moor-grass
Montia fontana	Blinks
Myosotis secunda	Creeping Forget-me-not
Nardus stricta	Mat Grass
Narthecium ossifragum	Bog Asphodel
Pinguicula vulgaris	Common Butterwort
Plantago lanceolata	Ribwort Plantain
Plantago major	Rat's-tail Plantain
Plantago maritima	Sea Plantain
Poa annua	Annual Meadow-grass
Poa compressa	Compressed Meadow-grass
Poa humilis	Spreading Meadow-grass
Poa pratensis	Smooth Meadow-grass
Polypodium vulgare	Polypodium
Potamogeton polygonifolius	Bog Pondweed
Potentilla erecta	Tormentil
Prunella vulgaris	Self-heal
Ranunculus acris	Meadow Buttercup
Ranunculus flammula	Lesser Spearwort
Rumex acetosa	Sorrel
Rumex acetosella	Sheep's Sorrel
Sagina procumbens	Procumbent Pearlwort
Salix herbacea	Least Willow
Schoenus nigricans	Black Bog-rush
Selaginella selaginoides	Selaginella
Sibbaldia procumbens	Sibbaldia
Stellaria uliginosa	Bog Stitchwort
Succisa pratensis	Devil's-bit Scabious
Taraxacum officinale agg.	Dandelion (not in flower)
Thalictrum alpinum	Alpine Meadow-rue
Thymus drucei	Wild Thyme
Trichophorum caespitosum	Deer Grass
Trifolium repens	White Clover
Triglochin palustris	Marsh Arrow-grass
Vaccinium myrtillus	Blaeberry
Vaccinium uliginosum	Northern Blaeberry
Viola palustris	Marsh Violet

Mosses, liverworts and algae

Amphidium mougeotii	A moss
Andreaea rupestris	A moss
Aneura pinguis	A liverwort
Anoectangium aestivum	A moss
Aulacomnium palustre	A moss
Barbilophozia floerkei	A liverwort
Barbilophozia hatcheri	A liverwort
Barbula unguiculata	A moss
Batrachospermum gelatinosum	Frogspawn Algae
Blepharostoma trichophylla	A liverwort
Blindia acuta	A moss
Bryum argenteum	A moss
Bryum capillare	A moss
Bryum pallens	A moss
Bryum pseudotriquetrum	A moss
Bryum sp.	A moss
Calliergonella cuspidata	A moss
Campylium stellatum	A moss
Campylopus atrovirens	A moss
Campylopus introflexus	A moss
Campylopus paradoxus	A moss
Ceratodon purpureus	A moss
Climacium dendroides	A moss
Ctenidium molluscum	A moss
Dicranella heteromalla	A moss
Dicranella palustris	A moss
Dicranum fuscescens	A moss
Dicranum scoparium	A moss
Diplophyllum albicans	A liverwort
Distichium capillaceum	A moss
Draparnaldia	An alga
Drepanocladus fluitans	A moss
Drepanocladus revolvens	A liverwort
Fissidens adianthoides	A moss
Fontinalis antipyretica	A moss
Frullania tamarisci	A liverwort
Grimmia funalis	A moss
Homalothecium sericeum	A moss
Hylocomium splendens	A moss
Hypnum cupressiforme	A moss
Hypnum jutlandicum	A moss
Isothecium myosuroides	A moss
Jungermannia atrovirens	A liverwort
Lophozia ventricosa	A liverwort
Marsupella emarginata	A liverwort
Mnium hornum	A moss
Mylia taylorii	A liverwort
Nardia compressa	A liverwort
Nardia scalaris	A liverwort

Nitella flexilis var. flexilis	Stonewort
Palustriella commutata	A moss
Pellia sp.	A liverwort
Philonotis fontana	A moss
Plagiochila porelloides	A liverwort
Plagiomnium elatum	A moss
Plagiomnium undulatum	A moss
Plagiothecium denticulatum	A moss
Plagiothecium undulatum	A moss
Pogonatum aloides	A moss
Pogonatum urnigerinum	A moss
Pohlia wahlenbergii	A moss
Polytrichum commune	A moss
Polytrichum juniperinum	A moss
Preissia quadrata	A liverwort
Racomitrium aciculare	A moss
Racomitrium heterostichum	A moss
Racomitrium lanuginosum	A moss
Rhizomnium punctatum	A moss
Rhytidiadelphus loreus	A moss
Rhytidiadelphus squarrosus	A moss
Scapania dentata	A liverwort
Scapania gracilis	A liverwort
Scleropodium purum	A moss
Scorpidium scorpioides	A moss
Sphagnum capillifolium	A moss
Sphagnum compactum	A moss
Sphagnum cuspidatum	A moss
Sphagnum denticulatum	A moss
Sphagnum mucronatum	A moss
Sphagnum palustre	A moss
Sphagnum papillosum	A moss
Sphagnum papillosum	A moss
Thuidium tamariscinum	A moss
Tortella tortuosa	A moss
Warnstorfia exannulata	A moss