

## Technical Appendix 8.1

# Kirkton Energy Park

## Extended Phase 1 Habitat and NVC Surveys

Kirkton Wind Farm Ltd.

**wind2**

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# 1 Introduction

## 1.1 Terms of Reference

In August 2020, Atmos Consulting Ltd. (Atmos) was commissioned by Kirkton Wind Farm Ltd. to undertake Phase 1 habitat and National Vegetation Classification (NVC) surveys for the proposed Kirkton Energy Park located approximately 2.1km south of Melvich, Sutherland (hereafter referred to as the "site").

This report describes the methods followed and habitats / NVC communities identified. The conservation status and potential groundwater dependency of the habitats present on site are also provided.

## 1.2 Site Location and Description

The site is situated approximately 2.1km south of the village of Melvich, in the Scottish Highlands with an approximate grid reference of NC 87999 59788 (Appendix A, Figure 8.1.1 refers).

The site is located in an area of grazing land, planted native woodland and blanket bog ranging in altitude from 20 to 160m Above Ordnance Datum (AOD). The highest area to the south comprises of large, nearly flat expanses of blanket bog.

The north of the site is roughly split into east and west sectors by the burn Allt na h-Eaglaise and its tributaries. The slopes to the west of this rise to a large block of commercial conifer plantation, and those to the east rise to a long hill at an altitude of approximately 100m AOD. An access track runs south from Kirkton Farm and along the eastern hill.

The south of the site is split by the burns Allt nan Gall and Allt an Tigh-choinneimh that drain east into the Halladale River.

The site is used mainly for sheep and cattle grazing, although there is also some planted and semi-natural woodland. There is some evidence of grazing pressure from deer. The survey area contains a variety of plant communities including blanket bog, wet heath, dry heath, acid grassland, acid flush, areas of continuous bracken, broad-leaved woodland, improved grassland and marshy grassland.

There are two fields located immediately adjacent to the A836 that have been identified as suitable for the creation of turning areas (only one would be required to be constructed): turning area A is located to the north west of the main site, adjacent to the building at Strathroy; and turning area B is located at the western edge of Melvich, adjacent to the road junction between the A836 and the road to Portskerra. Turning area A supports an improved grassland habitat and turning area B supports an improved grassland / marshy grassland mosaic.

## 1.3 Proposed Development

The proposed development will consist of up to eleven three-bladed horizontal axis wind turbines, each up to 149.9m above ground level (agl) maximum blade tip height and a rotor diameter of 133m. The final choice of turbine will be subject to a selection process which considers technical and commercial aspects of the turbines and would



be based on the turbine models which are commercially available at the time of construction.

Associated infrastructure includes hard standing areas for erecting cranes at each turbine location, on-site access tracks and turning heads, an on-site substation compound with control building and battery storage, and a temporary construction compound. The proposed development would be time limited to 30 years from the date of final commission.

## 1.4 Objectives

The objective of the study was to undertake a survey to document the Phase 1 habitat and NVC communities present within the site and appropriate buffers in order to evaluate their potential nature conservation interest and to assess the potential for Groundwater Dependent Terrestrial Ecosystems (GWDTEs) to be present.

This report provides details of the following:

- field survey methods;
- field survey results;
- description of the plant communities present within the site boundaries;
- initial peatland habitat condition assessment; and
- discussion of potential Ground Water Dependent Terrestrial Ecosystems (GWDTEs).

## 2 Methodology

### 2.1 Desktop Study

A desk study was undertaken in order to establish baseline information for the site. Various data sources were utilised including the website of the statutory agency, NatureScot via the 'Site Link Portal', and aerial photography for the site.

Desk study identified statutory designations such as Special Areas of Conservation (SACs), Ramsar wetlands, Sites of Special Scientific Interest (SSSIs) and National Nature Reserves (NNRs) within 10km of the site. In addition, Local Nature Reserves (LNRs) and relevant non-statutory designations within a 5km radius of the site were searched for.

### 2.2 Extended Phase 1 Habitat Survey

An extended Phase 1 habitat survey was undertaken on the 8 – 10 September 2020, 29 September – 1 October 2020, 5 October 2020, and 19 – 22 July 2021. Extended Phase 1 habitat survey is a standardised method of recording habitat types and characteristic vegetation, as set out in the *Handbook for Phase 1 Habitat Survey – a Technique for Environmental Audit* (JNCC, 2010). The habitat survey area covered the site and a buffer zone of 250m to identify any potential GWDTEs in accordance with Scottish Environment Protection Agency (SEPA) guidance. Species nomenclature follows standard guidance (Stace, 2010; Atherton *et al.*, 2010).

Habitats were mapped and field notes describing the composition and structure of the sward taken in order to describe characteristic habitats, features of ecological interest, or any features which require ecologically sensitive design or mitigation.

The survey method was 'extended' through the additional recording of specific features indicating the presence, or likely presence, of protected species or other species of nature conservation significance and any habitats which would be suitable for them. Overall, the main features of the survey were to:

- describe and map the habitats within the survey area;
- record evidence of protected species and other ecologically significant features; and
- assess the potential of the habitats as suitable for protected species.

Any incidental observations of bird species and any other notable species were made.

### 2.3 NVC Survey

The vegetation was surveyed by suitably qualified and experienced botanical surveyors using the NVC (Rodwell, 1991 – 2000, 5 volumes) and in accordance with NVC survey guidelines (Rodwell, 2006). The NVC scheme provides a standardised system for classifying and mapping semi-natural habitats and ensures that surveys are carried out to a consistent level of detail and accuracy.

Homogenous stands and mosaics of vegetation were identified and mapped by eye, drawn as polygons on field maps; these polygons were surveyed qualitatively to record dominant and constant species, sub-dominant species and other species present. In practice the vegetation was mapped progressively across the site to ensure that no

areas were missed and that mapping was accurate. An aerial photograph of the site was also used to aid accurate mapping of vegetation boundaries. NVC communities were attributed to the mapped polygons using surveyor experience and matching field data against published floristic tables (Rodwell, 1991 – 2000). Stands were classified to sub-community where possible.

Due to vegetation and habitat variability across the site, and the numerous transitional zones between similar NVC communities, a number of polygons represent complex mosaics of the NVC communities attributed to that respective polygon. Where polygons have been mapped as mosaics an attempt was made to give approximate percentage coverage of each NVC community within the polygon so that the dominant community could still be ascertained.

### 2.3.1 Groundwater Dependent Terrestrial Ecosystems

As part of the NVC exercise, any wetland habitats identified with the survey buffers stated earlier were evaluated in terms of their potential to be GWDTE, making reference to SEPA guidance (SEPA, 2017), modified from the United Kingdom Technical Advisory Group (UKTAG) list of NVC communities and associated groundwater dependency scores.

GWDTE are defined by the UKTAG (2003) as:

*“A terrestrial ecosystem of importance at Member State level that is directly dependent on the water level in or flow of water from a groundwater body (that is, in or from the saturated zone). Such an ecosystem may also be dependent on the concentrations of substances (and potential pollutants) within that groundwater body, but there must be a direct hydraulic connection with the groundwater body.”*

A detailed study of vegetation communities allows the potential level of groundwater dependency to be determined.

Determination of complete groundwater dependency is complicated by the ability of many vegetation communities to use whatever source of water is available. In some topographical and hydrogeological conditions, a particular community can be groundwater-dependent whereas in others the same community is surface water-dependent. Seasonal patterns of water use provide an additional level of complexity, with groundwater reliance typically being greater in the summer when rainfall and surface water are less available.

## 2.4 Limitations

All surveys were undertaken in suitable weather conditions (i.e. good visibility and no snow cover). While surveys were undertaken towards the middle to late period of the season, boundaries between vegetation community types were clearly identifiable and no significant limitations in terms of survey timing or weather conditions were identified.

Although every effort was made to identify all plants, habitats, mammal signs and any ecologically sensitive features, the results of the surveys should not be considered exhaustive.

## 3 Results

### 3.1 Desk Study

#### 3.1.1 Designated Sites

##### Statutory Designations

There are eleven sites designated for ecological interest in the vicinity (< 10km) of the site (Table 1 and Appendix A, Figure 8.1.2 refers).

**Table 1: Designated Sites**

| Designated Site                    | Designated Feature  | Distance from Site Boundary   |
|------------------------------------|---|---|
| <b>SACs</b>                        |   |   |
| Caithness and Sutherland Peatlands | Blanket bogs<br>Depressions on peat substrates<br>Otter <i>Lutra lutra</i><br>Acid peat-stained lakes and ponds<br>Wet heathland with cross-leaved heath <i>Erica tetralix</i><br>Clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels<br>Marsh saxifrage <i>Saxifraga hirculus</i><br>Transition mires and quaking bogs | Immediately adjacent to the western boundary of the site <sup>1</sup> |
| Strathy Point                      | Vegetated sea cliffs of the Atlantic and Baltic coasts  | c. 6.54km to the north west (at its closest point)                    |
| <b>Ramsars</b>                     |   |   |
| Caithness and Sutherland Peatlands | Blanket bog (Ramsar criterion 1)<br>Rare species of wetland plants and animals (Ramsar criterion 2)<br>Breeding population of dunlin <i>Calidris alpina schinzii</i> (Ramsar criterion 6)   | Immediately adjacent to the western boundary of the site <sup>1</sup> |
| <b>SSSIs</b>                       |   |   |
| West Halladale                     | Blanket bog<br>Breeding bird assemblage<br>Black-throated diver <i>Gavia arctica</i><br>Common scoter <i>Melanitta nigra</i>  | Immediately adjacent to the western boundary of the site <sup>1</sup> |
| East Halladale                     | Blanket bog<br>Breeding bird assemblage<br>Dunlin, breeding<br>Golden plover, breeding  | c. 1.50km to the east (at its closest point)                          |

<sup>1</sup> Includes a small overlap in the north west of the proposed development site to incorporate the entirety of the coniferous plantation there as part of the proposed Habitat Management Plan (Technical Appendix (TA) 8.5: Draft Habitat Management Plan refers).

| Designated Site     | Designated Feature  | Distance from Site Boundary                              |
|---------------------|---|--|
| Strathy Coast       | Moine structural and metamorphic geology<br>Machair<br>Maritime cliff<br>Sand dune<br>Saltmarsh<br>Vascular plant assemblage                            | c. 2.69km to the north east (at its closest point)       |
| Red Point Coast     | Non-marine Devonian stratigraphy<br>Quaternary of Scotland<br>Maritime cliff<br>Scottish primrose <i>Primula scotica</i><br>Guillemot <i>Uria aalge</i> | c. 4.55km to the north east (at its closest point)       |
| Lochan Buidhe Mires | Blanket bog<br>Breeding bird assemblage   | c. 6.37km to the west (at its closest point)             |
| Armadale Gorge      | Scrub woodland<br>Subalpine dry heath   | c. 6.81km to the west (at its closest point)             |
| Strathy Bogs        | Blanket bog   | c. 8.05km to the south west (at its closest point)       |
| <b>NNRs</b>         |   |  |
| Forsinard Flows     | Blanket bog<br>Breeding bird assemblage   | c. 6.95km to the south south east (at its closest point) |

The nearest element of woodland listed on the Ancient Woodland Inventory (AWI) (as held by NatureScot) is the north east corner of Strathy Forest, located approximately 4.32km to the north west of the site at its closest point. Although there is no legislation specifically protecting ancient woodland, Scottish Planning Policy identifies it as an important and irreplaceable national resource that should be protected and enhanced.

### 3.1.2 Aerial Photography

Review of aerial photography shows that the majority of the site is moorland comprising dry and wet heath and blanket bog. There are blocks of commercial conifer plantation scattered throughout the area, most notably along the north west edge of the application boundary, adjacent to Lochan Coulbackie, and in the south of the site, immediately north and north west of the properties at Upper Bighouse. Fields of rush-pasture and occasionally cereal crop are concentrated along the River Halladale corridor.

## 3.2 Extended Phase 1 Habitat Survey

### 3.2.1 Main Site (Overview)

The results of the extended Phase 1 habitat survey are presented on Figure 8.1.3, (Appendix A refers), with their areal extent shown in Table 2.

**Table 2: Phase 1 habitats and coverage within the survey area**

| Description   | Area (ha) | % of total area |
|---|-----------|-----------------|
| Acid dry dwarf shrub heath  | 10.17     | 2.43            |
| Acid or neutral flush or spring   | 3.25      | 0.77            |
| Blanket <i>Sphagnum</i> bog   | 142.71    | 34.03           |
| Continuous bracken  | 4.98      | 1.19            |
| Improved grassland  | 9.32      | 2.22            |
| Marshy grassland  | 22.38     | 5.34            |
| Planted broadleaved woodland  | 2.04      | 0.49            |
| Planted coniferous woodland   | 81.25     | 19.37           |
| Scrub gorse   | 0.03      | 0.007           |
| Semi-natural broadleaved woodland   | 4.50      | 1.07            |
| Wet dwarf shrub heath   | 72.34     | 17.25           |
| <b>Mosaics</b>  |           |                 |
| Acid dry dwarf shrub heath / Continuous bracken                                   | 3.20      | 0.76            |
| Acid dry dwarf shrub heath / Wet dwarf shrub heath                                | 2.30      | 0.55            |
| Acid or neutral flush or spring / Acid dry dwarf shrub heath / Continuous bracken | 0.02      | 0.004           |
| Acid or neutral flush or spring / Planted broadleaved woodland                    | 4.01      | 0.96            |
| Marshy grassland / Continuous bracken   | 0.03      | 0.007           |
| Marshy grassland / Improved grassland   | 1.06      | 0.25            |
| Marshy grassland / Semi-improved acid grassland                                   | 4.72      | 1.13            |
| Marshy grassland / Wet dwarf shrub heath  | 25.12     | 5.99            |
| Semi-improved acid grassland / Acid or Neutral flush or spring                    | 13.32     | 3.18            |
| Semi-improved acid grassland / Continuous bracken                                 | 2.07      | 0.49            |
| Semi-improved acid grassland / Wet dwarf shrub heath                              | 5.56      | 1.33            |
| Wet dwarf shrub heath / Blanket <i>Sphagnum</i> bog                               | 5.00      | 1.19            |
| Total   | 419.38    | 100.00          |

## Dominant Habitats

### Blanket Bog (E1.6.1)

This habitat occupies the largest area of the site, with wide expanses made up of deergrass *Trichophorum germanicum* to the south west, plus some lower-lying valley bogs containing more heather *Calluna vulgaris*, cross-leaved heath *Erica tetralix* and hare's-tail cotton-grass *Eriophorum vaginatum* in other parts of the site.

A variety of *Sphagnum* species were found including the uncommon Austin's bog-moss *S. austinii* that was evident with its characteristically hard, orange hummocks. The best examples of high blanket bog on site contained three species of sundew: round-leaved *Drosera rotundifolia*; oblong-leaved *D. intermedia*; and great *D. anglica*.

Apart from heather, the commonest dwarf shrub was cross-leaved heath as well as bog-myrtle *Myrica gale*. There was very little crowberry *Empetrum nigrum* and even less bilberry *Vaccinium myrtillus*. Frequent in the high bogs was common cotton-grass

*Eriophorum angustifolium*. Some of the high bogs were also notable for their abundant *Cladonia* lichens as well as woolly fringe-moss *Racomitrium lanuginosum*. The abundance of these species suggests bogs that are slightly drier than those with more *Sphagnum*.

The high, ochre bogs were all examples of the NVC community M17, whereas the greener valley bogs tended towards M19.

#### **Wet Dwarf Shrub Heath (D2)**

This habitat is also extensive on the site. Some examples occurred in mosaic with continuous bracken *Pteridium aquilinum*, dry heath, blanket bog, acid grassland and rush pasture. Heather was often co-dominant in these wet heaths, or at the very least, frequent. As with the bogs, both cross-leaved heath and bog-myrtle were frequent. *Cladonia* lichens were often abundant and the most frequent *Sphagnum* was acute-leaved bog-moss *S. capillifolium* subsp. *capillifolium*. Purple moor-grass *Molinia caerulea* was also frequent here as was wavy hair-grass *Deschampsia flexuosa* in some compartments.

All examples of this habitat translated to NVC community M15.

### **Minor Habitats**

#### **Acid / Neutral Flush / Spring (E2.1)**

The largest area of this habitat was in the west where it occurred in mosaic with acid grassland, dry heath and bracken, and broadly followed the burn Allt nan Gall and its tributaries draining the southern part of the site. Most of it was dominated by soft-rush *Juncus effusus* with star sedge *Carex echinata* becoming more prevalent locally. These two habitats correspond to NVC communities M6c and M6a respectively.

#### **Continuous Bracken (C1.1)**

Bracken was mainly found on the steeper, free-draining slopes of the site, usually in mosaic with wet heath, dry heath, acid flush, planted broad-leaved woodland, rush pasture, acid grassland and / or marshy grassland. There was abundant wavy hair-grass and frequent sweet vernal-grass *Anthoxanthum odoratum*, heath bedstraw *Galium saxatile*, Yorkshire-fog *Holcus lanatus*, soft-rush, wood-sorrel *Oxalis acetosella* and common haircap *Polytrichum commune*.

#### **Acid Dry Dwarf Shrub Heath (D1.1)**

This habitat tended to occupy steeper slopes on the site that were free-draining. All examples were dominated by heather, along with frequent wavy hair-grass and purple moor-grass. The pleurocarpous red-stemmed feather-moss *Pleurozium schreberi* was abundant. Many of these drier slopes had been planted with native broad-leaved trees, of which the dominant species was downy birch *Betula pubescens*.

All examples of this heath had small amounts of bell heather *Erica cinerea* and hardly any bilberry and therefore correspond to NVC community H10. It occurred in mosaic with acid flush, acid grassland, continuous bracken, wet heath and marshy grassland.

#### **Improved Grassland (B4)**

This habitat was found on the northern edge of the site and was being grazed by cattle and sheep at the time of survey. This example was dominated by common bent *Agrostis capillaris* along with white clover *Trifolium repens*. There was also frequent

spear thistle *Cirsium vulgare*, Yorkshire-fog and soft-rush, but otherwise the grassland was species-poor.

### **Marshy Grassland (B5)**

This habitat mostly takes the form of hard-grazed grassland dominated by soft-rush that is often co-dominant with heath-rush *Juncus squarrosus*. The ground can be wet but is not always so, and the vegetation has a speckled buff – green appearance. Wavy hair-grass is often abundant as well as frequent sweet vernal-grass and marsh thistle *Cirsium palustre*.

This habitat does not correspond with any recognisable NVC community. One small area also supported some yellow iris *Iris pseudacorus*, corresponding to NVC community M28.

### **Planted Broad-leaved Woodland (A1.1.2)**

Many of the watercourses and steeper, drier slopes on the site have been deer-fenced and planted with native broad-leaved woodland using the hinge-mounding technique. Some plantations were also found on areas of wet heath or towards the edges of blanket bog. Downy birch was normally dominant in the canopy and the shrub layer. The success of the planted trees is heavily dependent on the topography, with some being very stunted as opposed to a canopy of approximately 6m as observed elsewhere on site.

Other species planted were rowan *Sorbus aucuparia*, alder *Alnus glutinosa*, grey willow *Salix cinerea*, goat willow *Salix caprea*, silver birch *Betula pendula*, and hazel *Corylus avellana*. Heather and red-stemmed feather-moss were typically dominant on the ground.

Owing to the man-made nature of many of these planted habitats, it was difficult to assign an NVC community, though possible W4 and W17 did both occur. Locally, the low cover of a canopy layer suggested H10 with planted broad-leaves.

### **Planted Coniferous Woodland (A1.2.2)**

There were two occurrences of conifer plantation. The largest is situated in the north-west corner of the site and is co-dominated by Sitka spruce *Picea sitchensis* and lodgepole pine *Pinus contorta*. Here there are also a few larch *Larix* sp.

The ground layer is dominated by heather with abundant common cotton-grass that are mainly found in the rides.

There is also a small, inverted L-shaped plantation of lodgepole pine at the extreme south of the site.

This habitat does not carry an NVC classification.

### **Semi-Improved Acid Grassland (B1.2)**

These are largely areas dominated by wavy hair-grass, some of these with frequent heath bedstraw. There are few pure stands, and most occur in mosaics with acid flush, dry heath, bracken, rush pasture and wet heath. In general, these mosaics are relatively species-poor, and in many cases may indicate a history of burning of blanket bog or wet heath (Averis *et al.*, 2004).

Stands purely dominated by wavy hair-grass conform to NVC community U2, while those with some heath bedstraw tend to resemble U4.



### **Semi-Improved Neutral Grassland (B2.2)**

This habitat is present on site as a mosaic with marshy grassland, semi-improved acid grassland and improved grassland in the south-east corner around the properties at Bighouse. In general, the mosaic is relatively species-poor, dominated by soft-rush, heath-rush, common bent, wavy hair-grass, Yorkshire-fog, with frequent cock's-foot *Dactylis glomerata* and occasional false oat-grass *Arrhenatherum elatius*.

In stands where heath-rush is locally prominent, the habitat conforms to NVC community U6, while those with heath bedstraw and springy turf-moss *Rhytidiadelphus squarrosus* resemble U4.

### **Semi-Natural Broad-Leaved Woodland (A1.1.1)**

There is one example of semi-natural broad-leaved woodland in the small gorge in the lower section of the Allt nan Gall burn. Here, downy birch dominates the rather sparse canopy, with heather and bracken being co-dominant in the ground layer. There is frequent hard-fern *Blechnum spicant*, marsh thistle, big shaggy-moss *Rhytidiadelphus triquetrus* and also occasional eared willow *Salix aurita* in the shrub layer.

This habitat corresponds approximately with NVC community W17.

There is also some natural regeneration in the north of the site, along the channel of the Allt na h-Eaglaise watercourse, that comes under this category. This is hummocky woodland dominated by downy birch with frequent goat willow. The ground layer is very hummocky and is co-dominated by heather, purple moor-grass and red-stemmed feather-moss.

This habitat somewhat resembles NVC community W4.

### **Watercourses**

There are two main watercourse systems on the site, both split into a number of tributaries. Their gradient varies considerably through the site, but tends to be flatter in the upper reaches though still with frequent riffle-pool systems. The steeper sections have rocks with the bryophytes fountain apple-moss *Philonotis fontana*, rusty feather-moss *Brachythecium plumosum* and yellow fringe-moss *Racomitrium aciculare*. The flatter sections are dominated by common water-starwort *Callitriche stagnalis* along with frequent unbranched bur-reed *Sparganium emersum* and bog pondweed *Potamogeton polygonifolius*.

### **Tracks**

There is one track that runs from north to south into the site and terminates on the long hill in the east of the survey area. This consists of grassed-over hardcore and is approximately 4m wide.

## **3.2.2 Turning Areas**

The habitat at turning area A is improved grassland (B4). The short length of the sward is indicative of constant grazing by livestock. Species recorded here include common bent, white clover, occasional creeping thistle *Cirsium arvense*, Yorkshire-fog and springy turf-moss.

The habitat at turning area B is a mosaic of improved grassland (B4) and marshy grassland (B5). The sward length is longer than that recorded at turning area A but is still relatively short, reflecting the level of grazing by livestock. Species recorded here

are similar to that at turning area A with the addition of clumps of soft-rush scattered throughout.

### 3.3 NVC Survey

The findings of the NVC survey are presented on Figure 8.1.4 (Appendix A refers).

#### 3.3.1 Main Site (Overview)

The majority of vegetation within the site is dominated by blanket bog habitat and M17 *Trichophorum germanicum* – *Eriophorum vaginatum* and M19 *Calluna vulgaris* – *Eriophorum vaginatum* blanket mires in particular. On gentle slopes, the blanket mire floristically grades to M15 *Trichophorum germanicum* – *Erica tetralix* wet heath, with H10 *Calluna vulgaris* – *Erica cinerea* heath on steeper slopes.

Patches of M6 *Carex echinata* – *Sphagnum fallax* / *denticulatum* mire are present, most closely aligned with the upper reaches of the Allt na h-Eaglaise and Allt nan Gall watercourses and their tributaries.

In the north and south east of the survey area, the sward trends floristically towards a more grassland setting with communities U2 *Deschampsia flexuosa*, U4 *Festuca ovina* – *Agrostis capillaris* – *Galium saxatile*, and U6 *Juncus squarrosus* – *Festuca ovina* grasslands recorded in various mosaics with an unclassified rush-pasture habitat, and heath and mire communities.

Many of the watercourses and steeper, drier slopes on the site have been deer-fenced and support a planted / naturally regenerating woodland that most closely aligns with W4 *Betula pubescens* – *Molinia caerulea* / W17 *Quercus petraea* – *Betula pubescens* – *Dicranum majus* woodland, with patches of U20 *Pteridium aquilinum* – *Galium saxatile* community.

In the north west, south west and south east of the survey area there are dense blocks of commercial conifer plantation.

#### Community Descriptions

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

Analysis of the quadrat data from the steeper, drier slopes along the Allt na h-Eaglaise burn and in the north of the survey area shows that this community is present in a mosaic with M6 *Carex echinata* – *Sphagnum fallax* / *denticulatum* mire, U20 *Pteridium aquilinum* – *Galium saxatile* community, U4 *Festuca ovina* – *Agrostis capillaris* – *Galium saxatile* grassland and planted deciduous trees.

The H10 vegetation community is a heath of well-drained mineral, usually acid soils, and is common on steep, stony slopes. Many patches of H10 heath stand out clearly as patches of dark vegetation on steeper ground, contrasting with the paler tones of the surrounding bogs and wet heaths or the varied greens of upland grasslands. This community type rarely occurs above about 400m except in the mild, oceanic climate of the western Highlands and the Hebrides where it can ascend to almost 600m. Further north and east it is usually associated with warm south-facing or west-facing slopes at low altitudes.

These are dry heaths with a low, dark-coloured canopy of heather and bell heather. The dwarf shrubs are typically overtopped by the long, deep-green leaves and

drooping brownish flowers of green-ribbed sedge *Carex binervis*; tormentil *Potentilla erecta* and heath bedstraw scramble over the ground below the shrubs. There is usually a thick carpet of mosses such as red-stemmed feather-moss, little shaggy-moss *Rhytidiadelphus loreus*, glittering wood-moss *Hylocomium splendens* and heath plait-moss *Hypnum jutlandicum*.

These heaths comprise part of the range of variation within the internationally important heather moors of Great Britain. They are a good habitat for upland birds, including twite *Carduelis flavirostris*, merlin *Falco columbarius*, short-eared owl *Asio flammeus*, hen harrier *Circus cyaneus* and ring ouzel *Turdus torquatus*. Red grouse *Lagopus lagopus* also occur, although they are generally rather scarce in the west where these heaths are so common. Most forms of the community are not noted for rare plants, but the herb-rich H10d *Thymus polytrichus* – *Carex pulicaris* sub-community can include a few uncommon species.

In the **typical sub-community H10a**, heather is typically dominant and is often overwhelmingly abundant in pioneer or building regrowth after burning. Bell heather is very frequent and it can show some local prominence among or beneath the heather or very occasionally replace it as the leading sub-shrub with recovery from fire, but usually it is of sparse cover and sometimes altogether absent. Bilberry occurs occasionally, though hardly ever as more than scattered shoots and crowberry and cross-leaved heath are scarce and usually found in stands that are obviously transitional to the woolly fringe-moss sub-community H10b.

Monocotyledons are typically few and generally of low cover though wavy hair-grass, which is very frequent, sometimes shows local prominence. More striking here, though, is the preferential occurrence of purple moor-grass, usually not more than patchily abundant but, with occasional deergrass and heath-rush, often bringing the vegetation close in its composition to degraded forms of M15 *Trichophorum germanicum* – *Erica tetralix* wet heath, with which this vegetation often forms mosaics.

Velvet bent *Agrostis canina*, common bent and mat-grass *Nardus stricta* also occur occasionally at low covers, but sheep's-fescue *Festuca ovina* and sweet vernal-grass are characteristically uncommon and the grass-heath physiognomy of some other sub-communities is only rarely developed here. Apart from tormentil and occasional heath bedstraw, herbaceous dicotyledons are very sparse but there are sometimes scattered individuals of hard-fern.

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

Analysis of the quadrat data from the flat or gently sloping ground in the west of the site, predominantly associated with the watercourses Allt nan Gall and Allt na h-Eaglaise and their tributaries, shows that the vegetation most closely aligns with the community M6 *Carex echinata* – *Sphagnum fallax* / *denticulatum* mire.

Examples of this vegetation type also occur in mosaic with U2 *Deschampsia flexuosa* and U4 *Festuca ovina* – *Agrostis capillaris* – *Galium saxatile* grasslands, and H10 *Calluna vulgaris* – *Erica cinerea* heath, and W4 *Betula pubescens* – *Molinia caerulea* woodland.

These mires occur in wet hollows, seepage lines, flushes, shallow gullies cutting down hillsides, and along the margins of streams within expanses of blanket mire, dwarf shrub heath or acid grassland. They also occur around slow-flowing springs at the heads of rivers. M6 mires also cover level, ill-drained valley floors, and are common in neglected and abandoned pastures on the upland margins.

The soils beneath M6 flushes are deep, wet and usually peaty. The irrigating water is acid with a pH between 4.4 and 5.7. The supply of plant nutrients is greater than it is in the stagnant M1, M2 and M3 *Eriophorum angustifolium* bog pool communities, but less than it is in the base-rich small-sedge mires M10 *Carex dioica* - *Pinguicula vulgaris* mire, M11 *Carex viridula* ssp. *oedocarpa* – *Saxifraga aizoides* mire and M12 *Carex saxatilis* mire. M6 is mainly a community of the sub-montane zone up to about 400m.

These are soligenous mires with a sward of sedges or rushes over a dense layer of the mosses flat-topped bog-moss *Sphagnum fallax*, cow-horn bog-moss *Sphagnum denticulatum*, blunt-leaved bog-moss *Sphagnum palustre* and common haircap; papillose bog-moss *Sphagnum papillosum* and springy turf-moss can be common here too. The sward is usually interleaved with velvet bent and purple moor-grass. The only forbs are marsh violet *Viola palustris* and tormentil, though there may also be a little heath bedstraw or marsh thistle.

M6 mires do not have a rich flora and are not the home of many rare plant species. They do, however, contribute to the diversity of the vegetation of the upland margins. They can be the only places with wet, soft ground amid great tracts of dry heather moorland and short unimproved grassland. As such, they are valuable habitats for insects and spiders, and provide feeding grounds for a range of upland birds whose chicks require invertebrate food. Waders such as curlew *Numenius arquata*, snipe *Gallinago gallinago* and redshank *Tringa totanus*, and ducks such as mallard *Anas platyrhynchos* and teal *Anas crecca*, often conceal their nests among the tufts of rushes and sedges.

There are four sub-communities, defined by the sedge *Carex* sp. or rush *Juncus* sp. that predominate in the sward.

The ***Carex echinata* sub-community a** is a dull-green assemblage generally dominated by mixtures of sedges with star sedge generally the most common, with frequent carnation sedge *Carex panicea* and common sedge *Carex nigra*. Grasses are rather scarce except for purple moor-grass and velvet bent which are generally common. Common cotton-grass is frequent and can dominate locally. Rushes are typically scarce and of low cover.

The *Sphagnum* carpet is typically extensive and luxuriant. Blunt-leaved bog-moss is common but flat-topped bog-moss and cow-horn bog-moss are interchangeable, the latter becoming more prominent in the oceanic far west of Britain. Round-leaved sundew, bog asphodel *Narthecium ossifragum*, cross-leaved heath, bulbous rush *Juncus bulbosus* and bogbean *Menyanthes trifoliata* show some preference for the cow-horn bog-moss type of flush.

The ***Carex nigra* – *Nardus stricta* sub-community b** is characterised by a mix of frequent common, carnation and star sedges, with generally very common mat-grass, heath-rush and common cotton-grass among a patchy *Sphagnum* cover. Sheep's-fescue and sweet vernal-grass are common and the vegetation can resemble flushed grassland. Heath-rush is preferential but soft-rush is scarce and sharp-flowered rush *Juncus acutiflorus* absent.

In some stands, flat-topped bog-moss and blunt-leaved bog-moss are the commonest *Sphagnum* species with poor fen herbs such as lesser spearwort *Ranunculus flammula*, marsh willowherb *Epilobium palustre* and marsh thistle.

In the ***Juncus effusus* sub-community c**, sedges are less frequent and varied and much less abundant and the vegetation is dominated physiognomically by soft-rush, occurring as prominent tussocks. Sharp-flowered rush was also recorded in small patches. Also recorded were velvet bent, tormentil, heath bedstraw, purple moor-grass, star sedge and marsh violet.

The *Sphagnum* carpet was generally extensive with flat-topped bog-moss dominant with some blunt-leaved bog-moss, cow-horn bog-moss and occasional papillose bog-moss. Common haircap was also recorded, especially at the periphery.

#### **M15 *Trichophorum germanicum* – *Erica tetralix* wet heath**

Analysis of the quadrat data from flat or gently sloping ground in the east and south of the site shows that the vegetation most closely aligns with community M15 *Trichophorum germanicum* – *Erica tetralix* wet heath, and in places, the typical sub-community b.

Some examples of this vegetation type also occur in mosaic with M17 *Trichophorum germanicum* – *Eriophorum vaginatum* and M19 *Calluna vulgaris* – *Eriophorum vaginatum* blanket mires, H10 *Calluna vulgaris* – *Erica cinerea* heath and U4 *Festuca ovina* – *Agrostis capillaris* – *Galium saxatile* grassland.

This community is a vegetation type with few constants and wide variation in the pattern of dominance and in the associated flora. In general, these wet heaths are vast, ochre-brown tracts of moorland consisting of a mix of species such as heather, cross-leaved heath, deergrass and purple moor-grass, entwined with tormentil, and pricked through by the narrow, upright shoots of bog asphodel and the long, dark green leaves of common cotton-grass.

The M15 wet heath is a community of shallow, wet or intermittently waterlogged, acid peat or peaty mineral soils on hillsides, over moraines, and within tracts of blanket mire. It also extends on to deep peat where the original bog vegetation has been damaged or modified by burning, drainage and peat cutting.

The sub-communities occupy different terrain: the more soligenous *Carex panicea* sub-community occurs in hollows, channels and soakaways; the typical sub-community on shallow slopes at low to moderate altitudes; the *Cladonia* spp. sub-community on steeper slopes with thinner peat and at higher elevations; and the *Vaccinium myrtillus* sub-community on drier substrates. The species-poor *Calluna vulgaris* – *Molinia caerulea* form of the typical sub-community typically occurs in places that are recovering from moderate to heavy grazing. Most stands of this wet heath are at low to moderate altitudes, within the altitudinal range of woodland, but the *Cladonia* spp. and *Vaccinium myrtillus* sub-communities can occur at well over 600m in the west Highlands.

Very little of this type of wet heath is natural, although some higher-altitude stands of the *Cladonia* spp. sub-community on rocky slopes may be nearly so, and wet heaths might always have occupied open, boggy glades even when the upland landscape was well wooded. There would once have been woodlands on most of the ground that is now covered with this type of vegetation. When woodlands are cleared and there are no trees to take up water, the soils can become waterlogged and wet heaths may develop on shallow slopes. Some examples of wet heath have been derived directly from blanket mire in response to burning and grazing.

Most stands of this type of wet heath are grazed by deer and sheep and are sporadically managed by burning, usually in large patches. Without grazing and burning these heaths could potentially revert to woodland, although this might be a slow process on the impoverished acid soils, and without grazing the dwarf shrubs and purple moor-grass might in some places grow so tall and dense that tree seedlings would not easily compete. Planted trees will grow in this community, especially if the ground is first prepared by drainage, and many commercial forestry plantations are on slopes where there was once this community.

Grazing, especially by deer and cattle, seems to be necessary to maintain the structural and floristic diversity of the community by reducing competition from heather and purple moor-grass. However, too much grazing can reduce the vegetation to a species-poor sward of deergrass with few dwarf shrubs, especially if the heaths are also burned. Such treatments, especially if combined with drainage, can eventually convert this wet heath type to grassland dominated by mat-grass, heath-rush or purple moor-grass. If the vegetation is not grazed at all, or if it is drained, heather and purple moor-grass may come to dominate in a dense species-poor sward where little else has room to grow. Burning can help to maintain this wet heath, as long as it is not done too frequently. Severe burning on a short rotation can remove much of the peaty soil, producing a sparse sward of impoverished vegetation on dry, patchy peat interspersed with gravel and stones. If burning is carried out, the ideal method is to burn every 10–20 years with superficial fires, which burn away the old woody growth of the shrubs and the purple moor-grass litter but which do not destroy the bryophytes or scorch the soil.

However, some vegetation should be left unburnt to grow tall as nesting habitat for breeding birds. The diverse habitat that results from this kind of management is also valuable for invertebrates. Wet heaths should not be burned if the dwarf shrubs are wind-clipped, nor if they are on shallow rocky soils with a dense layer of mosses or lichens; consequently, most stands of the *Cladonia* spp. sub-community should not be burned. Burning should also be avoided on the wetter stands of the *Carex panicea* sub-community as they are important breeding grounds for insects and feeding sites for upland birds.

The **typical sub-community M15b** has a thick, tufted sward of heather, cross-leaved heath, purple moor-grass and deergrass, and locally, a thick speckling of bog-myrtle. Under the canopy there is usually a layer of purple moor-grass litter. There are commonly small patches of acute-leaved bog-moss, cow-horn bog-moss, papillose bog-moss and purple spoonwort *Pleurozia purpurea*. Some stands are dense, tall, species-poor swards dominated by heather and purple moor-grass.

Small sedges are generally sparse with only carnation sedge and star sedge occurring occasionally. Both mat-grass and heath-rush can show local prominence.

Typically, the cover of *Sphagnum* species such as acute-leaved bog-moss and papillose bog-moss is variable and patchy, and in places, woolly fringe-moss, broom fork-moss *Dicranum scoparium*, red-stemmed feather-moss and cypress-leaved plait-moss *Hypnum cupressiforme* provide most of the cover.

#### **M17 *Trichophorum germanicum* – *Eriophorum vaginatum* blanket mire**

Analysis of the quadrat data from flat or gently sloping ground in the west of the site shows that the vegetation most closely aligns with community M17 *Trichophorum germanicum* – *Eriophorum vaginatum* blanket mire.



Some examples also occur in a mosaic with vegetation community types M15 *Trichophorum germanicum* – *Erica tetralix* wet heath and M19 *Calluna vulgaris* – *Eriophorum vaginatum* blanket mire.

This mire community type is characteristic of the mild and wet climate of the western uplands where rainfall exceeds evapotranspiration, the soils become waterlogged and anaerobic, and the dead remains of plants eventually form a thick layer of peat. This insulates the vegetation from the underlying rock and from groundwater, and almost all nutrients are received from mist, rain and snow. Whole landscapes can become enveloped in peat, and *Trichophorum germanicum* – *Eriophorum vaginatum* mire can be the prevailing type of vegetation over many square kilometres.

Most stands are on level ground or gentle slopes, but in the Outer Hebrides and in north west Sutherland the community clothes surprisingly steep slopes, perhaps as a result of a predominantly cool and wet climate resulting in the accumulation of deep, waterlogged peat even on sloping ground. The peat is acid, with a pH of about 4. In the western Highlands, M17 is most common below about 450m, but further east and south it occurs at slightly higher elevations.

The pale ochre-gold sheets of this mire are composed of hare's-tail and common cotton-grass, deergrass and purple moor-grass, dotted with darker clumps of heather and cross-leaved heath. Beneath the vascular plants there are shallow spongy mats of papillose bog-moss and acute-leaved bog-moss. Small vascular plants prick up through the layer of mosses: the red-gold spikes of bog asphodel, the red, sticky rosettes of sundew *Drosera* species, the trailing, rich-green shoots of tormentil, and in some places the stiff green leaves of heath spotted-orchid *Dactylorhiza maculata* with its conspicuous spotted pale lilac flowers in early summer.

The mire surface is corrugated into a system of pools and hummocks, each with characteristic assemblages of *Sphagnum* and other plants. Some of the pools belong to vegetation community type M1 *Sphagnum denticulatum* bog pool community or M2 *Sphagnum cuspidatum* / *fallax* bog pool community. The largest pools occur in the north and west of Scotland, where up to 50% of the mire surface may be open water. The pools can form spectacular ladder-systems on gentle slopes and reticulate patterns on shallow domes.

**M17a *Drosera rotundifolia* – *Sphagnum* spp. sub-community** commonly occurs in the most consistently wet conditions. Among the vascular dominants, mixtures of heather and deergrass, or heather and purple moor-grass commonly make up the bulk of the cover overall, with hare's-tail cotton-grass sometimes showing local abundance on more elevated areas, cross-leaved heath tending to increase in the wetter, such zonation being especially obvious where hummocks and hollows are strongly differentiated.

Occasionally, purple moor-grass can be much more obviously dominant over the other species, a situation that seems to be particularly associated with a reduction in the cover of deergrass and, more noticeably, of hare's-tail cotton-grass. Bog-myrtle is preferentially frequent in this sub-community and locally abundant, but it is rather irregular in its representation and can be totally absent from some areas. Bilberry and crowberry hardly ever occur but bell heather can be found occasionally in drier places, where the vegetation grades to sub-community b *Cladonia* spp.

Among the vascular associates, round-leaved sundew is strongly preferential here and particularly frequent around wetter hollows, where it can occasionally be

accompanied by great sundew or oblong-leaved sundew. In such situations, too, there can be some star sedge, few-flowered sedge *Carex pauciflora* or bog-sedge *Carex limosa*.

*Sphagnum* species are especially varied and extensive in this sub-community and, over undulating ground, they show an obvious zonation over the hummocks and transitions to hollows. The most abundant species are generally acute-leaved bog-moss, which is concentrated over the hummock sides and tops, and papillose bog-moss, which assumes dominance around the lower fringes of the hummocks and sometimes forms tussocky lawns in flatter wet areas, at around the level of the water table. Compact bog-moss *Sphagnum compactum* occurs occasionally, mostly among the acute-leaved bog-moss, with soft bog-moss *Sphagnum tenellum* and lustrous bog-moss *Sphagnum subnitens* frequent among the papillose bog-moss.

**M17b *Cladonia* spp. sub-community** occurs on slightly drier peats, for example where the surface has been dried out by burning. Its name is deceptive as it's woolly fringe-moss rather than *Cladonia* lichens, that define this sub-community. Woolly fringe-moss grows in silvery-green patches and low hummocks which are often visible from afar, giving the mire a distinctive knobbed appearance. Lichens are common, and in the far north west Highlands can grow thickly enough to make the vegetation look as if it sprinkled with snow.

Heather and deergrass are fairly consistent co-dominants with purple moor-grass and cross-leaved heath playing a subordinate role, and hare's-tail cotton-grass distinctly patchy. Bog-myrtle is scarce and bell heather quite frequent and locally prominent. The *Sphagnum* carpet is much impoverished with acute-leaved bog-moss as the main species, often rather patchy in cover, and all other species reduced in frequency. Bog plants such as *Drosera* species are also reduced in occurrence.

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

Analysis of the quadrat data from flat or gently sloping ground in the centre to east of the site shows that the vegetation most closely aligns with community M19 *Calluna vulgaris* – *Eriophorum vaginatum* blanket mire.

Some examples also occur in a mosaic with vegetation community types M15 *Trichophorum germanicum* – *Erica tetralix* wet heath and M17 *Trichophorum germanicum* – *Eriophorum vaginatum* blanket mire.

M19 mire covers watersheds and gentle slopes where a deep layer of peat has been able to accumulate. It occurs on drier peats than either M17 or M18 communities. Although the mire surface can be ragged with hags and wet peaty channels containing common cotton-grass, there are rarely the pools and hollows characteristic of wetter mires, nor is there often water lying over the peat surface. The peat itself is generally firm, moist and fibrous rather than wet and slimy.

M19 mire is a more northern, boreal and montane type of vegetation than M17 mire. Although it occurs locally below 100m in north west Scotland, most stands are at higher altitudes. In the west of Great Britain, it generally replaces M17 mire above about 350m. The more montane forms of the *Vaccinium vitis-idaea* – *Hylocomium splendens* sub-community c extend the altitudinal range of the community to over 900m on the high plateaux of the Cairngorms, Lochnagar and Caenlochan.

These are mires with a dense, shaggy, purple-brown and dark-green, tussocky sward of heather and hare's-tail cotton-grass, speckled with the long, shining, deep-green



leaves of common cotton-grass, straggling shoots of bilberry, and low clumps of crowberry. *Sphagnum* can be prominent over wetter ground but typically this element is not so rich or luxuriant as in the M17 or M18 mires. There is usually a deep rich-red-gold quilt of acute-leaved bog-moss, lustrous bog-moss and large mosses such as glittering wood-moss, red-stemmed feather-moss, heath plait-moss, little shaggy-moss and waved silk-moss *Plagiothecium undulatum*. In many places the vegetation is broken by hags, with great spreads of bare peat, especially in larger stands.

The hummock / hollow relief that is commonly found in M17 and M18 communities is only rarely developed here, though the surface of the ground is often uneven because of the marked tussockiness of hare's-tail cotton-grass, a structural feature of some importance for the strong contingent of hypnoid mosses, which constitute a further distinctive component over drier surfaces.

The proportion of hare's-tail cotton-grass to the ericoid sub-shrubs is very variable and, though it shows some consistency in the different sub-communities, it is very much affected by certain kinds of treatment, particularly by burning and grazing which can help convert the vegetation into M20 *Eriophorum vaginatum* blanket and raised mire, where the cotton-grass is overwhelmingly dominant and the sub-shrubs of much more patchy occurrence. Variation between the two communities is continuous and replacement of the richer M19 by the more impoverished M20 can be temporary, so transitions are common.

In general, however, the two can be separated by the very frequent occurrence here of heather, bilberry and crowberry and, at higher altitudes, of cowberry *Vaccinium vitis-idaea* and bog bilberry *Vaccinium uliginosum*. Overall, heather is the most common co-dominant of hare's-tail cotton-grass, but diverse mixtures of these species occur very frequently and typically the sub-shrubs are so abundant and so vigorous, especially over the drier ground, as to give the vegetation the appearance of a heathy moorland.

Compared with the strongly oceanic blanket bog vegetation of the M17 mire, deergrass often plays a subordinate role here, purple moor-grass is strikingly scarce and herbs such as tormentil, heath milkwort *Polygala serpyllifolia*, and lousewort *Pedicularis sylvatica* are very infrequent.

Few other features of the vascular flora are distinctive, though wavy hair-grass and heath-rush occur occasionally throughout and each can be locally abundant and, at higher altitudes, stiff sedge *Carex bigelowii* becomes frequent. Mat-grass, common sedge and heath bedstraw can be found at low frequencies. By and large, herbs here are few in number and occur as scattered individuals.

The bryophyte flora is rich and often extensive, frequently covering more than 50% of the ground, a further difference between this community and M20 mire. However, varied and luxuriant carpets of *Sphagnum* are not the rule in this community. Acute-leaved bog-moss is sufficiently frequent throughout to qualify as a constant and it can be locally abundant, but even this species is somewhat patchy. Papillose bog-moss, lustrous bog-moss and soft bog-moss, prominent in the wet lawns of other ombrogenous mires, and the semi-aquatic species feathery bog-moss *Sphagnum cuspidatum* and cow-horn bog-moss, which can figure elsewhere in transitions to bog pools, are generally uncommon and rather uneven in their occurrence.

Typically, however, it is hypnaceous mosses which provide the constancy to the bryophyte layer in this community. Among these, red-stemmed feather-moss, little

shaggy-moss, cypress-leaved plait-moss or heath plait-moss and waved silk-moss are all very frequent throughout, with glittering wood-moss becoming common at higher altitudes. Mixtures of these can form extensive mats over drier areas of the ground, particularly over the tops of old hare's-tail cotton-grass hummocks and among the stools of sub-shrubs where the bushes have opened up somewhat.

Three sub-communities are described in the NVC, but they do not represent the most obvious patterns of floristic and ecological variation among the M19 community. In broad terms, the sub-communities form a series from oceanic, southern or western vegetation to northern, boreal and montane vegetation. The ***Erica tetralix* sub-community M19a**, which descends to the lowest altitudes and is the most common form in the far west, has cross-leaved heath, deergrass and purple moor-grass, and in some places with a sprinkling of bog asphodel or round-leaved sundew; cloudberry *Rubus chamaemorus* is generally absent. Glittering wood-moss is listed as a characteristic species of this sub-community in the floristic tables, but it is so common in M19 mire generally that it cannot be used as an indicator of any particular sub-type.

### **M23 *Juncus effusus* / *acutiflorus* – *Galium palustre* rush-pasture**

Analysis of the quadrat data from the north of the site, and immediately adjacent to the access track in particular, shows that the vegetation most closely aligns with community M23 *Juncus effusus* / *acutiflorus* – *Galium palustre* rush-pasture.

This vegetation community type also occurs in a mosaic with vegetation community type U20 *Pteridium aquilinum* – *Galium saxatile* community, also in the north of the site and adjacent to the access track in particular.

These communities are relatively easy to distinguish on gently sloping hillsides, along the margins of streams, and in marshy valleys. In the western Highlands and the Inner Hebrides, *Juncus* – *Galium* rush-pasture is common on level marshy ground close to the shore. Both types, but especially the *Juncus effusus* sub-community b, are also common in neglected damp pastures and in ditches around fields and settlements in the upland margins. The community is sub-montane and occurs from high-tide level in the western Highlands to just over 400m. In northern Scotland, it is rare above 200m.

This rush-pasture occurs on peaty mineral soils and stagnogleys, often with a strong smell of decomposing vegetation. The soils are acid to neutral with a pH between 4 and 6. They are kept wet throughout the year by flushing and seepage, and there can be some standing water in winter. The *Juncus acutiflorus* sub-community a tends to occur on wetter substrates than the *Juncus effusus* sub-community b.

This community comprises tall, deep-green swards of a mixture of soft-rush and sharp-flowered rush, entwined with grasses such as Yorkshire-fog, purple moor-grass, velvet bent and sweet vernal-grass, common marsh-bedstraw *Galium palustre*, and in most places a mixture of other mesotrophic herbs. On the wet ground under the rushes, there is a thin weft of bryophytes.

No particularly rare plants have been recorded in upland examples of *Juncus* – *Galium* rush-pasture, but some stands are home to uncommon oceanic species such as whorled caraway *Carum verticillatum*, lesser skullcap *Scutellaria minor* and ivy-leaved bellflower *Wahlenbergia hederacea*. Even without rare species, mires of this type contribute to the diversity of flora and vegetation structure around the upland fringes, and they add colour and texture to the landscape. The herb-rich stands of the *Juncus acutiflorus* sub-community a are valuable centres of genetic diversity because the

vascular plants are usually able to flower and set seed. Both sub-communities are a fine habitat for invertebrates and birds; curlew, lapwing *Vanellus vanellus*, snipe and redshank often nest in rushy pastures where there is a mosaic of M23 vegetation and unimproved or slightly improved grassland.

Almost all of these mires are probably derived from woodland or scrub. They occur well within the altitudinal range of woodland but the invasion of woody species is held in check by grazing. If stands were fenced against livestock they might well be colonised by trees, perhaps initially by grey willow and eared willow. The *Juncus acutiflorus* sub-community a has a flora similar to that of herb-rich W7 *Alnus glutinosa* – *Fraxinus excelsior* – *Lysimachia nemorum* woodland, and many plants of this form of wet woodland are able to persist in the mire vegetation without a canopy of trees. The *Juncus effusus* sub-community b seems to have less in common with the ground vegetation of semi-natural woodlands.

Most stands are grazed by sheep, cattle or deer; the *Juncus effusus* sub-community b is usually more heavily grazed than the *Juncus acutiflorus* sub-community a because it tends to occur on drier soils and to be more intimately associated with pastures. Many stands of the *Juncus acutiflorus* sub-community a are grazed by cattle in autumn, when the old flowering stems of the herbs form a sort of standing hay. It is fairly easy to drain mires of this type and reclaim them for agriculture, and many stands have been lost in this way. They can readily be converted to U4 *Festuca ovina* – *Agrostis capillaris* – *Galium saxatile* grassland and, if this is then limed and fertilised, to MG6 *Lolium perenne* – *Cynosurus cristatus* grassland.

#### **M28 *Iris pseudacorus* – *Filipendula ulmaria* mire**

Analysis of the quadrat data from the north of the site, and the lower reaches of the channel of the Allt na h-Eaglaise in particular, shows that the vegetation here is a mosaic of M28 *Iris pseudacorus* – *Filipendula ulmaria* mire and U20 *Pteridium aquilinum* – *Galium saxatile* community.

This mire is floristically and ecologically related to M23 *Juncus effusus* / *acutiflorus* – *Galium palustre* rush-pasture and M27 *Filipendula ulmaria* – *Angelica sylvestris* tall-herb fen. The dominant species vary between the different communities, but they all share the same associated flora of tall mesotrophic herbs. The three communities can form complex mosaics, but the tall sword-like leaves of yellow iris stand out in well-defined patches clothing damp, more or less neutral soils at very low altitudes. The distribution and relative proportions of the different rush-pasture and fen types are determined by local variation in soil conditions, grazing and probably also cultivation. Yellow iris can flourish only where the climate is mild and oceanic, and most stands of this type occur close to the sea, extending only a few kilometres inland and rarely occurring above 150m.

This mire community comprises tall green swards of yellow iris, interleaved with other tall herbs such as meadowsweet *Filipendula ulmaria* and hemlock water-dropwort *Oenanthe crocata*. Other associated species include meadow buttercup *Ranunculus acris*, marsh thistle and common sorrel *Rumex acetosa*, and the grasses tufted hair-grass *Deschampsia cespitosa*, rough meadow-grass *Poa trivialis*, creeping bent *Agrostis stolonifera*, and Yorkshire-fog.

This attractive community is a rare, near-natural form of vegetation which forms an important element in the varied mosaics of grasslands and mires along the west

Highland and Hebridean coasts. In the Hebrides, this mire type is an important habitat for breeding Corncrakes *Crex crex*.

Most stands of M28 mire are subject to light grazing at most. If the vegetation is grazed hard, the yellow iris does not grow so tall and may be reduced to scattered, shorn-off stumps. The characteristic tall herbs are grazed out and the community is eventually converted to an open, grassy and impoverished sward. Drainage can also convert this mire into grassland. As with M27 *Filipendula* – *Angelica* fen, invasion by trees is possible but appears to take place very slowly, if at all.

## **U2 *Deschampsia flexuosa* grassland**

Analysis of quadrat data from the upper reaches of the corridor of the southern tributary to the Allt na h-Eaglaise watercourse, and from a noticeably grassier sward located beyond the application boundary to the south west shows that the vegetation most closely aligns with the community U2 *Deschampsia flexuosa* grassland.

Examples of this vegetation type also occur in mosaic with U20 *Pteridium aquilinum* – *Galium saxatile* community in the lower reaches of the corridor of the southern tributary to the Allt na h-Eaglaise watercourse, with M6c *Carex echinata* – *Sphagnum fallax* / *denticulatum* mire *Juncus effusus* sub-community c in the corridor of the Allt nan Gall, and with M15 *Trichophorum germanicum* – *Erica tetralix* wet heath in the north east of the site.

This grassland community is typical of slopes and valley sides with base-poor, moist, free-draining soils. It is a lowland to sub-montane vegetation type, and rarely, if ever, occurs above 600m. In many places this community represents the first stage of recolonising vegetation within felled conifer plantations where it forms an untidy grassland among the dead stumps and branches of the felled trees. It can also replace blanket bog vegetation where the peat has dried out as a result of excessive burning.

This is a tussocky grassland dominated by fine-leaved, dark-green clumps of wavy hair-grass. The smooth rounded tufts of this plant can give the sward a characteristic quilted appearance, and the tall, delicate, silvery-pink panicles of flowers are conspicuous in summer.

Within the stand, the cover of wavy hair-grass is rarely complete, but its strongly tussocky habit and its ability to spread rhizomatously mean that it characteristically exerts a controlling effect on the distribution of many of the other species. This is visible, first, in the generally impoverished nature of the vegetation, in which there is but one other constant, hardly any other associates occurring commonly throughout and rather sparse preferential floras in the two sub-communities. And, second, although even occasional species of the community can sometimes show local prominence, there are no consistent patterns of co- or sub-dominance.

In particular, other grasses and sub-shrubs are typically subordinate. Heather is the only other species that occurs commonly overall, but it is characteristically found as sparse shoots and is sometimes absent altogether. And, although bilberry and crowberry are recorded fairly frequently, they are very much confined to sub-community b and even there are of low cover. So, though the community is often seen in close association with a variety of heaths throughout its range and grades into them structurally, the balance of dominance in typical stands helps distinguish the vegetation types.

As for grasses, the most frequent associates are those which form the basis of other fine calcifuge swards, with sheep's-fescue and common bent both common, sweet vernal-grass, velvet bent, creeping bent and red fescue *Festuca rubra* occurring more occasionally. All these species are rather unevenly distributed throughout the community and, although the first two in particular can be patchily abundant, they never rival the dominance of wavy hair-grass except very locally. Likewise, purple moor-grass and mat-grass are sometimes found as scattered tussocks.

Other, more conspicuous, species which can add diversity to the community are hare's-tail cotton-grass, though its tussocks are never more than a subordinate element in the flora, heath-rush and soft-rush, both only occasional but the latter sometimes locally prominent, and bracken, found as sparse shoots or in small patches.

Bryophytes and lichens are not usually a conspicuous component of the vegetation, with only very occasional cypress-leaved plait-moss, waved silk-moss, nodding thread-moss *Pohlia nutans* and springy turf-moss occurring through this community. But some stands have local enrichment from acrocarpous mosses and *Cladonia* spp. while in others bulky pleurocarps or even *Sphagnum* spp. can make a prominent contribution.

Much U2 grassland has probably been derived from various forms of dwarf-shrub heath as a result of burning and grazing. In a few places, it has replaced blanket bog vegetation on drained peat. The community is maintained by grazing, principally by sheep and rabbits.

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

This vegetation community was identified on the site, in a number of mosaics. Firstly in the north with M6 *Carex echinata* – *Sphagnum fallax* / *denticulatum* mire *Carex echinata* sub-community a and *Carex nigra* – *Nardus stricta* sub-community b and H10 *Calluna vulgaris* – *Erica cinerea* heath; secondly in the north adjacent to the lower reaches of the Allt na h-Eaglaise with *Juncus* pasture; thirdly in the east with M15 *Trichophorum germanicum* – *Erica tetralix* wet heath; and finally in the south east corner with *Juncus* pasture and U6 *Juncus squarrosus* – *Festuca ovina* grassland, *Agrostis capillaris* – *Luzula multiflora* sub-community d.

This is a grassland of acid brown earths and brown podsolic soils that drain freely but can be moist. U4 grasslands have a vast altitudinal range: the various sub-communities cover the whole spread of the uplands from near sea level to over 1000m. The community is most common in upland regions where the rocks are acid to at least moderately base-rich and where there has been a long history of grazing.

These grasslands are usually short and tightly grazed, and vary in colour from dull, grey-green or pale ochre-green to a brighter rich green that can stand out clearly from the sombre tones of other upland vegetation. The dense turfs of sheep's-fescue, common bent and sweet vernal-grass are trailed through by heath bedstraw and tormentil. There is usually a thick carpet of bryophytes around the vascular plants, in which springy turf-moss is one of the most common species.

Most forms of U4 grassland have less interest for nature conservation than the heaths and woodlands with which they are typically associated. However, the herb-rich, flushed forms can be very species-rich and only develop where there is little or no grazing. Other forms of the community generally lack notable plants but the habitat does provide valuable nesting habitat for skylark *Alauda arvensis* and wheatear *Oenanthe oenanthe*. Where they occur over deep soils they can be an important



habitat for moles in otherwise rocky or peat-covered uplands where there are few worms.

The ***Holcus lanatus* – *Trifolium repens* sub-community b** has a less mossy sward and can include some species characteristic of more improved grasslands. Red fescue often replaces sheep's-fescue here as a co-dominant with common bent and sweet vernal-grass and there is usually some Yorkshire-fog in the sward. Small patches of cock's-foot and smooth meadow-grass *Poa pratensis* are scattered throughout.

Both heath bedstraw and tormentil are rather less common than usual, replaced in the sward by white clover, yarrow *Achillea millefolium* and common mouse-ear *Cerastium fontanum*. Ribwort plantain *Plantago lanceolata*, common sorrel and daisy *Bellis perennis* are also present at sparse occurrence.

Among the bryophyte layer, calcifuge species are scarce, with springy turf-moss and neat feather-moss *Pseudoscleropodium purum* being the most frequent.

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

The *Agrostis capillaris* – *Luzula multiflora* sub-community d of this vegetation type was identified on site in a mosaic in the south east corner, near the properties of Upper Bighouse, with *Juncus* pasture and U4b *Festuca ovina* – *Agrostis capillaris* – *Galium saxatile* grassland *Holcus lanatus* – *Trifolium repens* sub-community b.

This is a vegetation type of damp, peaty soils or gleyed podsols on flat or gently sloping ground. The soils are moist and can be waterlogged. The community is generally indifferent to underlying geology, but the scarce species-rich stands are associated with base-rich rocks, particularly the Dalradian schist and limestone of the central Highlands. Most stands occur between 400m and 800m.

These deep-green, tussocky swards stand out clearly from the surrounding vegetation on hillsides and plateaux. The dense rosettes of heath-rush are entwined with trailing shoots of tormentil and heath bedstraw, and enmeshed with the mosses red-stemmed feather-moss, common haircap, glittering wood-moss, springy turf-moss and little shaggy-moss.

Most stands of U6 grassland are anthropogenic in origin and are apparently unique to Great Britain and Ireland, where they owe their existence to the combination of an oceanic climate and a long history of burning and grazing.

Where this community covers peaty soils on upper slopes and plateaux it has usually replaced some sort of bog or wet heath from which the dwarf shrubs and other characteristic species have been lost by repeated burning and grazing. Heath-rush is fairly unpalatable to sheep, although it is grazed by cattle and ponies. As appears to be the case with U5 *Nardus stricta* – *Galium saxatile* grassland, the abandonment of mixed grazing in the uplands may have encouraged the spread of U6 vegetation at the expense of U4 grassland. In the absence of grazing, heath-rush is soon out-competed by other graminoids, and after only a year or two of reduced grazing the rosettes of heath-rush begin to be overgrown by other species. If this treatment was continued these swards would probably develop into more mixed grasslands and eventually into damp heath, wet heath or blanket bog. At lower altitudes it might be possible for woodland to become established.

***Agrostis capillaris* – *Luzula multiflora* sub-community d** is the grassiest form and comprises variegated swards in which velvet bent, sweet vernal-grass, wavy hair-grass,

mat-grass and viviparous fescue *Festuca vivipara* either form discrete patches or grow in mixtures with heath-rush.

Among the bryophytes, common haircap is unusually infrequent but springy turf-moss and cypress-leaved plait-moss are often joined by glittering wood-moss, with occasional red-stemmed feather-moss.

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

This vegetation community was identified on site in discrete patches in the north, along the corridor of the Allt na h-Eaglaise, and in the east adjacent to the lower reaches of the Allt nan Gall.

The community was also identified in mosaic in the north with M28 *Iris pseudacorus* – *Filipendula ulmaria* mire, in the west along the corridor of the southern tributary to the Allt na h-Eaglaise with U2 *Deschampsia flexuosa* grassland and H10 *Calluna vulgaris* – *Erica cinerea* heath, and in the east beyond the site boundary with H10 *Calluna vulgaris* – *Erica cinerea* heath.

This community is identified by the dominance of bracken, and is typical of the zone where the farmed lowlands adjoin the unenclosed uplands. It is most common on lower hill slopes and on marginal ground, including abandoned fields, where it forms mosaics with heaths, grasslands and woodlands. The community covers fairly deep, well-drained but moist, base-poor and infertile soils. It is absent from wet ground and strongly flushed slopes. Bracken is intolerant of frost and its altitudinal range is therefore limited by exposure. Soils at higher altitudes also tend to be too shallow, rocky or peaty, although the community can develop on dry peat where bogs have been cut-over or drained. The upper altitudinal limit of the U20 community appears broadly to correspond with that of native woodland at around 600m and is most extensive below 450m. Stands can cover huge areas of hillside, but it is also common to see small discrete patches.

Stands of bracken contribute to the diversity of vegetation on lower hill slopes, and are not completely devoid of wildlife interest. Whinchat *Saxicola rubetra* is one of the few birds strongly associated with bracken, but other birds also use the habitat for breeding.

In the ***Anthoxanthum odoratum* sub-community a**, there is a grassy sward beneath the bracken consisting of common bent, sheep's-fescue, sweet vernal-grass, Yorkshire-fog, heath bedstraw, tormentil, common sorrel, and common dog-violet *Viola riviniana*, and the bryophytes springy turf-moss, heath plait-moss and neat feather-moss.

#### **W4 *Betula pubescens* – *Molinia caerulea* woodland**

An element of planted broad-leaved woodland in the north around the northern tributary of the Allt na h-Eaglaise most closely aligns with this and / or W17 *Quercus petraea* – *Betula pubescens* – *Dicranum majus* woodland.

There is also a small element of naturally regenerating W4 woodland along the corridor of the Allt nan Gall. The community was also recorded in the east of the site in mosaic with M6 *Carex echinata* – *Sphagnum fallax* / *denticulatum* mire *Juncus effusus* sub-community c.

This vegetation community type is common on flushed slopes, in poorly drained gullies and valley bottoms, and in hollows with impeded drainage. It commonly forms small patches among other types of woodland, especially W11 *Quercus petraea* – *Betula pubescens* – *Oxalis acetosella* and W17 *Quercus petraea* – *Betula pubescens* –

*Dicranum majus* woodlands. W4 woodland is the counterpart of W7 *Alnus glutinosa* – *Fraxinus excelsior* – *Lysimachia nemorum* woodland on acid soils, and the soils are wet, moderately acid peats. On adjacent open ground it can grade into mires, heaths and grasslands, especially M25 *Molinia caerulea* – *Potentilla erecta* mire and M15 *Trichophorum germanicum* – *Erica tetralix* wet heath.

W4 woodland is wet woodland with a green, grassy, ground flora. Downy birch, alder, weaved willow and grey willow, some of them old, distorted and covered with lichens and bryophytes, stand over a lush field layer of purple moor-grass. The bryophytes blunt-leaved bog-moss, flat-topped bog-moss and common haircap grow in rich-green carpets over the soft, wet ground.

Few rare vascular species have been recorded in this woodland type, but the epiphytic flora of bryophytes and lichens can be rich and, in the west, can include some important oceanic species.

Grazing pressure can reduce, and in certain stands, reduce the coverage of young trees. This may eventually lead to a failure to regenerate and ultimately to the loss of the trees altogether. M25 mire and M15 wet heath can be grazed derivatives of W4 woodland. Draining can dry out the soils and eventually lead to a change to a drier type of woodland, such as W11 *Quercus petraea* – *Betula pubescens* – *Oxalis acetosella* or W17 *Quercus petraea* – *Betula pubescens* – *Dicranum majus* woodlands.

The ***Sphagnum* sub-community c** occurs on the wettest soils. It has sheets of flat-topped bog-moss and blunt-leaved bog-moss, and less papillose bog-moss and spiky bog-moss *Sphagnum squarrosum*. A few bog species such as cross-leaved heath, heather, common cotton-grass and hare's-tail cotton-grass may also grow here.

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

An element of planted broad-leaved woodland in the north along the corridor of the lower reaches of the Allt na h-Eaglaise most closely aligns with this and / or W4 *Betula pubescens* – *Molinia caerulea* woodland.

There is also one example of semi-natural W17 woodland in the small gorge in the lower section of the Allt nan Gall burn.

W17 woodland is the characteristic upland woodland of steep, rocky hillsides on thin, moist, free-draining acid mineral soils. The underlying rocks are usually hard and acid, and include granite, Pre-Cambrian sandstone and gneiss, Dalradian schist, Ordovician and Silurian slate and shale, and Carboniferous Millstone Grit. Most stands are below 450m, but this woodland type does extend to almost 700m on a few sheltered slopes in the western Highlands. It generally replaces W11 woodland on thinner and more acid soils, on steeper, rockier slopes, and at higher altitudes.

This community type includes heathy and mossy woodlands with a canopy of sessile oak *Quercus petraea* and downy birch dotted with rowan. Dwarf shrubs predominate in the field layer: either dark, shaggy stands of heather or dense, green mats of bilberry. More distinctively, there are great quantities of bryophytes, growing in variegated mats and patches over the ground. The most common species are glittering wood-moss, little shaggy-moss, red-stemmed feather-moss, waved silk-moss, and broom fork-moss *Dicranum scoparium*.

Some stands of W4 woodland on steep rocky slopes and in ravines may never have been felled, and may be survivors of the original natural woodland. Many examples of



the community are rather species-poor and without scarce plants, but the western *Isoetecium myosuroides* – *Diplophyllum albicans* sub-community a is one of the most important British habitats for oceanic bryophytes and lichens.

The ***Anthoxanthum odoratum* – *Agrostis capillaris* sub-community c** is grassier than the other sub-communities, and there can be a few or no dwarf shrubs, but there is still a rich array of bryophytes growing in extensive carpets and hummocks. Goat willow is fairly common.

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

Analysis of the quadrat data from the north of the site, to the north of the site entrance in particular, shows that the vegetation most closely aligns with community W23 *Ulex europaeus* – *Rubus fruticosus* scrub.

W23 scrub occurs on acid, freely draining soils on gentle to very steep, rocky slopes at low altitudes. Its highest localities are at about 300 – 350m on south-facing slopes as far apart as the eastern Highlands and south-west England. The vegetation is mainly secondary, developing after woodland clearance or on abandoned pasture. Progression to woodland may be held in check by reintroduction of stock or by burning. The natural habitats of W23 scrub are steep, rocky slopes on thin soils that cannot support a continuous canopy of tall trees, unstable habitats such as riverside shingle banks, and temporarily disturbed ground after fires in woodland and heath.

This scrub is dominated by gorse *Ulex europaeus* with its dark-green, spiny shoots and golden, coconut-scented flowers. In some stands gorse is replaced by broom *Cytisus scoparius*. Beneath the gorse and broom there is usually just a sparse and species-poor flora of plants such as bramble *Rubus fruticosus*, raspberry *Rubus idaeus*, common bent and bracken. Bramble is most common in lowland stands of W23 scrub and is absent from many stands in the uplands.

W23 scrub is not notable for rare species, but it is an important component of varied mosaics of vegetation, especially in south-west England and Wales, and contributes to the structural diversity of moorland vegetation. It can be an important habitat for birds, for example linnet *Carduelis cannabina*, yellowhammer *Emberiza citrinella*, whinchat, stonechat *Saxicola torquata* and whitethroat *Curruca communis*.

Gorse can invade grasslands where the intensity of grazing has been reduced, and once established can tolerate a considerable amount of grazing. Many patches of W23 scrub appear to have spread out from steep, rocky and unstable ground into surrounding grassland after stock grazing has been discontinued. In this way it can threaten the existence of short, species-rich grasslands that depend on heavy grazing. Gorse is resistant to fire and appears to thrive when burnt, sprouting up from the base of the stem. Even so, it is often burnt off in spring in an attempt to stop it colonising grassland. In many places there are ungrazed tracts of gorse scrub where woodland regeneration is limited by periodic fires, a lack of seed sources, and time. Where gorse is not rejuvenated by fire the bushes can grow tall and leggy. The canopy opens up and more light reaches the ground. As a result, more continuous vegetation, such as grassland, can develop under the gorse.

### **Unclassified Habitats**

There are a number of habitats within the survey area that are unclassified in terms of NVC communities. These include stands of commercial conifer plantation, planted deciduous low woodland, mixed woodland, improved grassland and *Juncus* pasture.

### 3.3.2 Abnormal Load Turning Areas

#### Turning Area A

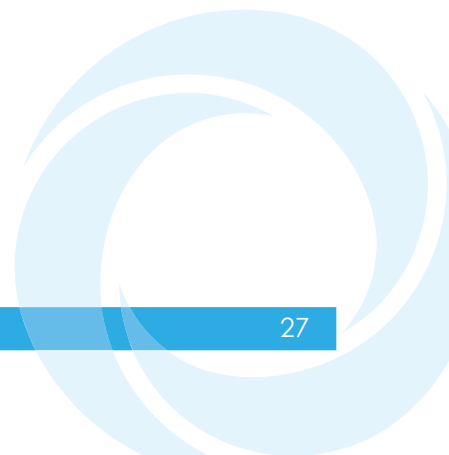
This is a single, well-grazed field with a short sward. Heavy grazing has resulted in a very species-poor improved grassland pasture habitat.

#### Turning Area B

Analysis of the quadrat data from the field of turning area B shows that the vegetation most closely aligns with the community *MG6 Lolium perenne – Cynosurus cristatus* grassland.

In lowland Britain, the *Lolium – Cynosurus* grassland is a major permanent pasture type on moist but freely draining or moderately impeded circumneutral, mesotrophic brown soils. Enclosed stands form the bulk of agricultural pasture in the country and it is also found widespread on roadside verges and lawns (Rodwell *et al.*, 1992; Cooper, 1997). This grassland community is usually characterised by a short, tight sward which is grass dominated by species including perennial rye-grass *Lolium perenne* and varying levels of crested dog's-tail *Cynosurus cristatus* (Rodwell *et al.*, 1992; Cooper, 1997).

Heavy grazing by domestic livestock has resulted in a relatively short sward length, characterised by clumps of soft-rush. The vegetation most closely aligns with the variable **MG6a typical sub-community**, as indicated by the presence of white clover and occasional meadow buttercup.



## 4 Evaluation

Table 3 evaluates each of the NVC communities recorded in the survey area in terms of nature conservation interest and potential groundwater dependence with respect to SEPA (2017).

**Table 3: Evaluation of Recorded NVC Communities**

| Phase 1 habitat / NVC Community  | Potential Groundwater Dependence                    | Nature Conservation Status  |
|--|---|---|
| H10 <i>Calluna vulgaris</i> – <i>Erica cinerea</i> heath                             | None  | European dry heaths (Annex 1)<br>Alpine and Boreal heaths (Annex 1)<br>Upland heathland (SBL)   |
| M6 <i>Carex echinata</i> – <i>Sphagnum fallax</i> / <i>denticulatum</i> mire         | High  | Upland flushes, fens and swamps (SBL)   |
| M15 <i>Trichophorum germanicum</i> – <i>Erica tetralix</i> wet heath                 | Moderate (dependent on the hydrogeological setting) | Northern Atlantic wet heaths with <i>Erica tetralix</i> (Annex 1)<br>Alpine and Boreal heaths (Annex 1)<br>Degraded raised bogs still capable of natural regeneration (Annex 1)<br>Blanket bogs (Annex 1)<br>Blanket bog (SBL)<br>Upland flushes, fens and swamps (SBL)<br>Upland heathland (SBL) |
| M17 <i>Trichophorum germanicum</i> – <i>Eriophorum vaginatum</i> blanket mire        | None  | Blanket bogs (Annex 1)<br>Depressions on peat substrates of the <i>Rhynchosporion</i> (Annex 1)<br>Blanket bog (SBL)<br>Upland heathland (SBL)  |
| M19 <i>Calluna vulgaris</i> – <i>Eriophorum vaginatum</i> blanket mire               | None  | Active raised bogs (Annex 1)<br>Blanket bogs (Annex 1)<br>Depressions on peat substrates of the <i>Rhynchosporion</i> (Annex 1)<br>Blanket bog (SBL)<br>Upland heathland (SBL)  |
| M23 <i>Juncus effusus</i> / <i>acutiflorus</i> – <i>Galium palustre</i> rush-pasture | High  | Purple moor-grass and rush pastures (SBL)<br>Upland flushes, fens and swamps (SBL)  |
| M28 <i>Iris pseudacorus</i> – <i>Filipendula ulmaria</i> mire                        | Moderate (dependent on the hydrogeological setting) | Blanket bog (SBL)<br>Upland flushes, fens and swamps (SBL)  |
| U2 <i>Deschampsia flexuosa</i> grassland   | None  | Upland flushes, fens and swamps (SBL)<br>Upland heathland (SBL)<br><i>Juncus squarrosus</i> – <i>Festuca ovina</i> grassland (SBL)<br><i>Nardus stricta</i> – <i>Galium saxatile</i> grassland (SBL)  |
| U4 <i>Festuca ovina</i> – <i>Agrostis</i>  | None  | Species-rich <i>Nardus</i> grassland on   |

| Phase 1 habitat / NVC Community   | Potential Groundwater Dependence                    | Nature Conservation Status  |
|---|---|---|
| <i>capillaris</i> – <i>Galium saxatile</i> grassland                                  |   | siliceous substrates in mountain areas (Annex 1)<br>Upland heathland (SBL)<br><i>Juncus squarrosus</i> – <i>Festuca ovina</i> grassland (SBL)<br><i>Nardus stricta</i> – <i>Galium saxatile</i> grassland (SBL)   |
| U6 <i>Juncus squarrosus</i> – <i>Festuca ovina</i> grassland                          | Moderate (dependent on the hydrogeological setting) | Species-rich <i>Nardus</i> grassland on siliceous substrates in mountain areas (Annex 1)<br>Upland heathland (SBL)<br><i>Juncus squarrosus</i> – <i>Festuca ovina</i> grassland (SBL)<br><i>Nardus stricta</i> – <i>Galium saxatile</i> grassland (SBL) |
| U20 <i>Pteridium aquilinum</i> – <i>Galium saxatile</i> community                     | None  |   |
| MG6 <i>Lolium perenne</i> – <i>Cynosurus cristatus</i> grassland                      | None  |   |
| W4 <i>Betula pubescens</i> – <i>Molinia caerulea</i> woodland                         | High  | Caledonian forest (Annex 1)<br>Bog woodland (Annex 1)<br>Upland birchwoods (SBL)<br>Wet woodland (SBL)  |
| W17 <i>Quercus petraea</i> – <i>Betula pubescens</i> – <i>Dicranum majus</i> woodland | None  | Old sessile oakwoods (Annex 1)<br>Caledonian forest (Annex 1)<br>Upland birchwoods (SBL)<br>Wet woodland (SBL)  |
| W23 <i>Ulex europaeus</i> – <i>Rubus fruticosus</i> scrub                             | None  |   |
| Conifer plantation  | None  |   |
| Deciduous low woodland  | None  |   |
| Mixed woodland  | None  |   |
| Improved grassland  | None  |   |
| <i>Juncus</i> pasture   | None  | Purple moor-grass and rush pastures (SBL)   |

#### Definitions:

|           |  |
|-----------|--|
| Annex 1 - | Annex 1 of the European Union Habitats Directive (92/43/EEC) |
| SBL -     | Scottish Biodiversity List                                   |

## 5 References

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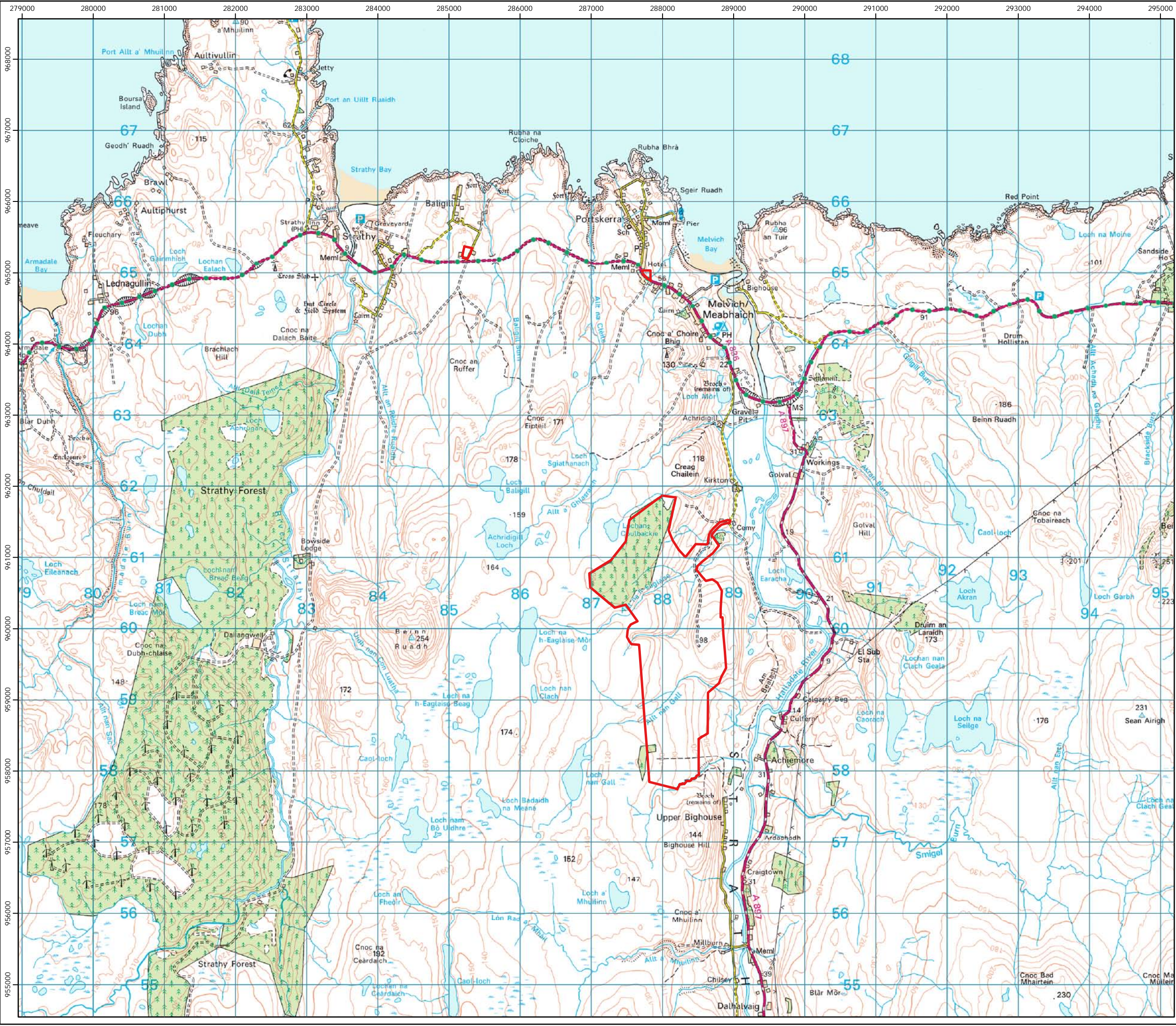
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## Appendices

### Appendix A. Figures

- Figure 8.1.1 - Site Location
- Figure 8.1.2 - Environmental Designations
- Figure 8.1.3 - Phase 1 Habitat Survey Results
- Figure 8.1.4 - NVC Survey Results





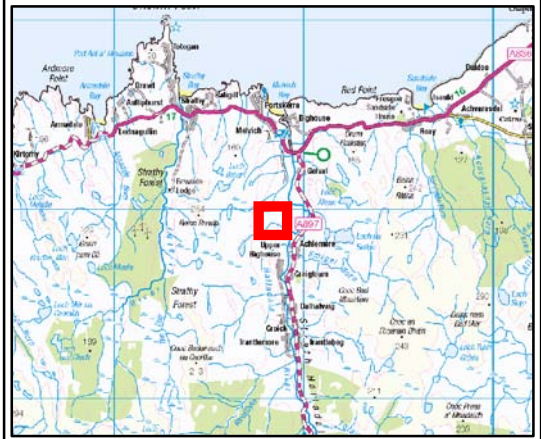
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Figure 8.1.1 Site Location

**Key**

Site boundary



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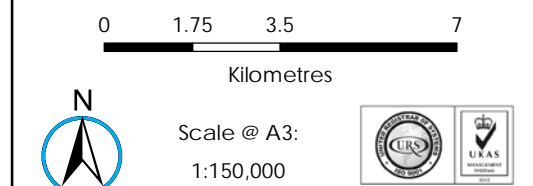
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Figure 8.1.2  
Environmental Designations

- Key**
- Site boundary
  - 5km buffers to 20km
  - Special Area of Conservation
  - Ancient Woodland Inventory
  - Special Protection Area
  - National Nature Reserve
  - Site of Special Scientific Interest
  - RSPB Reserve
  - RAMSAR wetland
  - RSPB Important Bird Areas



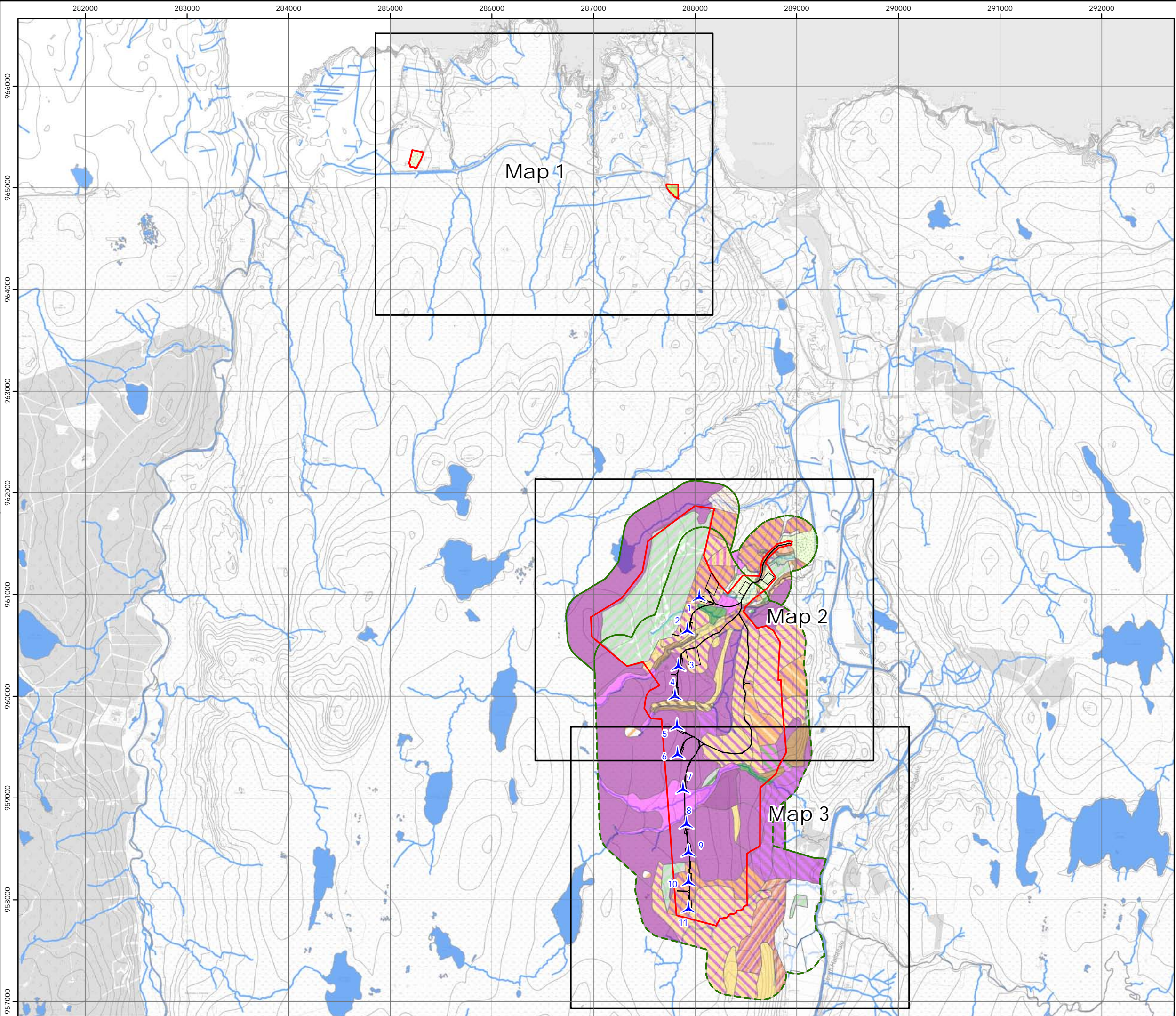
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# Kirkton Energy Park

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Figure 8.1.3  
Phase 1 Habitat Survey Results  
Overview

**Key**

- Proposed turbine
- Proposed infrastructure
- Site boundary
- Survey area

**Phase 1 Habitats**

|   |  |
|---|--|
| Acid/neutral flush / Broadleaved woodland - plantation                          | Semi-improved acid grassland / Wet dwarf shrub heath |
| Marsh/marshy grassland / Wet dwarf shrub heath                                  | Semi-improved acid grassland / Bracken               |
| Marshy Grassland (B5) / Improved Grassland (B4)                                 | Semi-improved acid grassland / Acid/neutral flush    |
| Acid/neutral flush / Dry dwarf shrub heath - acid / Bracken                     | Scattered Broadleaved trees                          |
| Marsh/marshy grassland / Acid grassland - semi-improved                         | Broadleaved woodland - semi-natural                  |
| Acid grassland - semi-improved / Marsh/marshy grassland / Wet Dwarf shrub heath | Broadleaved woodland - plantation                    |
| Acid Grassland semi-improved/ Wet dwarf shrub heath                             | Coniferous woodland - plantation                     |
| Dry dwarf shrub heath - acid / Bracken  | Scrub Gorse  |
| Dry dwarf shrub health acid / Wet dwarf shrub health                            | Acid grassland - semi-improved                       |
| Wet dwarf shrub heath / Blanket sphagnum bog                                    | Improved grassland                                   |
| Wet dwarf shrub heath / Dry dwarf shrub heath - acid                            | Marsh/marshy grassland                               |
| Wet dwarf shrub heath / Marsh/marshy grassland                                  | Marsh/marshy grassland / Bracken - continuous        |
|   | Bracken - continuous                                 |
|   | Dry dwarf shrub heath - acid                         |
|   | Wet dwarf shrub heath                                |
|   | Blanket sphagnum bog                                 |
|   | Flush and spring - acid/neutral flush                |
|   | Neutral grassland - semi-improved                    |
|   | Cultivated/disturbed land - arable                   |

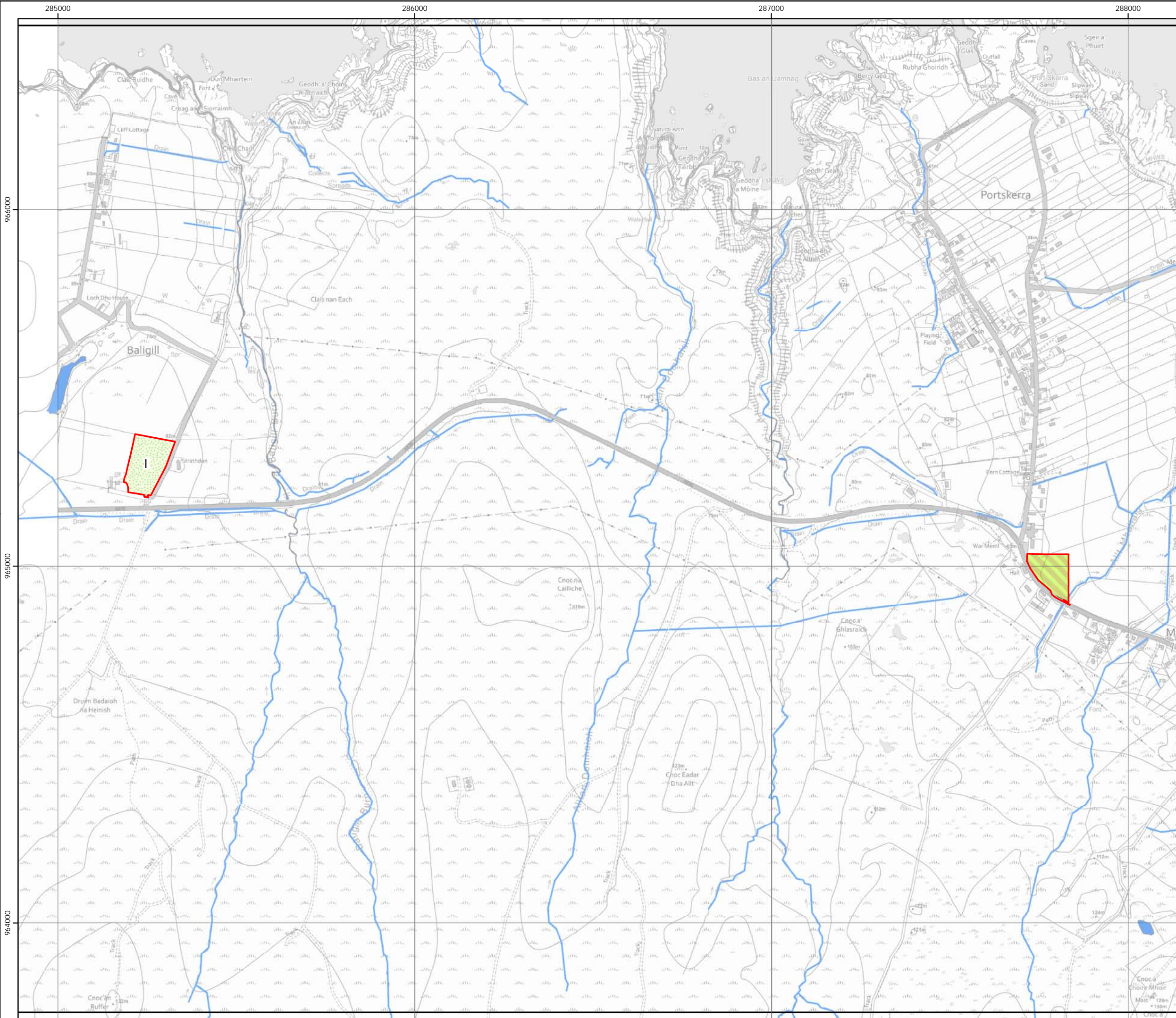
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# Kirkton Energy Park

## Kirkton Wind Farm Ltd

Figure 8.1.3  
Phase 1 Habitat Survey Results  
Map 1

**Key**

- Proposed turbine
- Proposed infrastructure
- Site boundary
- Survey area

**Phase 1 Habitats**

|   |  |
|---|--|
| Acid/neutral flush / Broadleaved woodland - plantation                          | Semi-improved acid grassland / Wet dwarf shrub heath |
| Marsh/marshy grassland / Wet dwarf shrub heath                                  | Semi-improved acid grassland / Bracken               |
| Marshy Grassland (B5) / Improved Grassland (B4)                                 | Semi-improved acid grassland / Acid/neutral flush    |
| Acid/neutral flush / Dry dwarf shrub heath - acid / Bracken                     | Scattered Broadleaved trees                          |
| Marsh/marshy grassland / Acid grassland - semi-improved                         | Broadleaved woodland - semi-natural                  |
| Acid grassland - semi-improved / Marsh/marshy grassland / Wet Dwarf shrub heath | Broadleaved woodland - plantation                    |
| Acid Grassland semi-improved/ Wet dwarf shrub heath                             | Coniferous woodland - plantation                     |
| Dry dwarf shrub heath - acid / Bracken  | Scrub Gorse  |
| Dry dwarf shrub heath acid / Wet dwarf shrub heath                              | Acid grassland - semi-improved                       |
| Wet dwarf shrub heath / Blanket sphagnum bog                                    | Improved grassland                                   |
| Wet dwarf shrub heath / Dry dwarf shrub heath - acid                            | Marsh/marshy grassland                               |
| Wet dwarf shrub heath / Marsh/marshy grassland                                  | Marsh/marshy grassland / Bracken - continuous        |
|   | Bracken - continuous                                 |
|   | Dry dwarf shrub heath - acid                         |
|   | Wet dwarf shrub heath                                |
|   | Blanket sphagnum bog                                 |
|   | Flush and spring - acid/neutral flush                |
|   | Neutral grassland - semi-improved                    |
|   | Cultivated/disturbed land - arable                   |



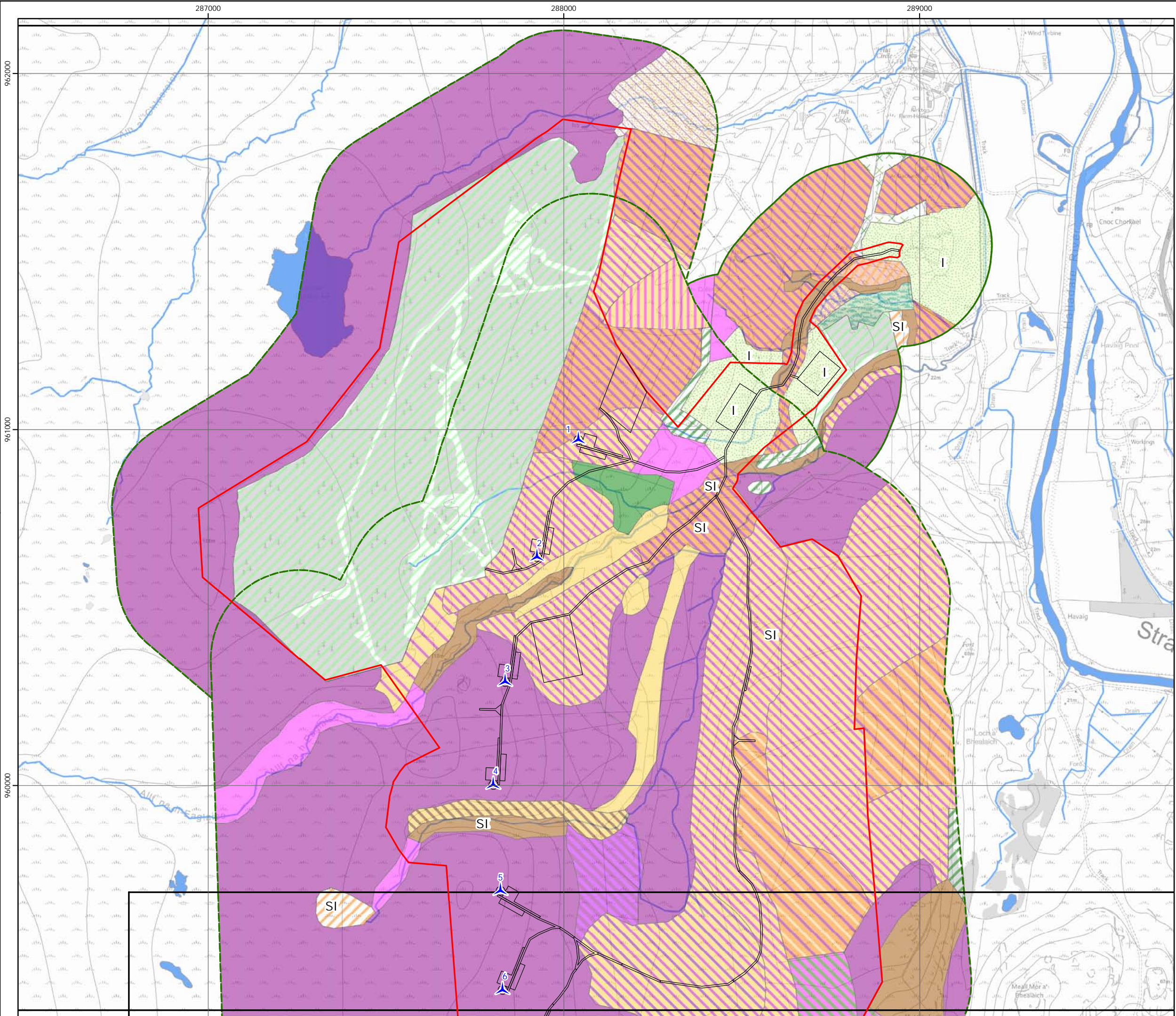
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Figure 8.1.3  
Phase 1 Habitat Survey Results  
Map 2

**Key**

- Proposed turbine
- Proposed infrastructure
- Site boundary
- Survey area

**Phase 1 Habitats**

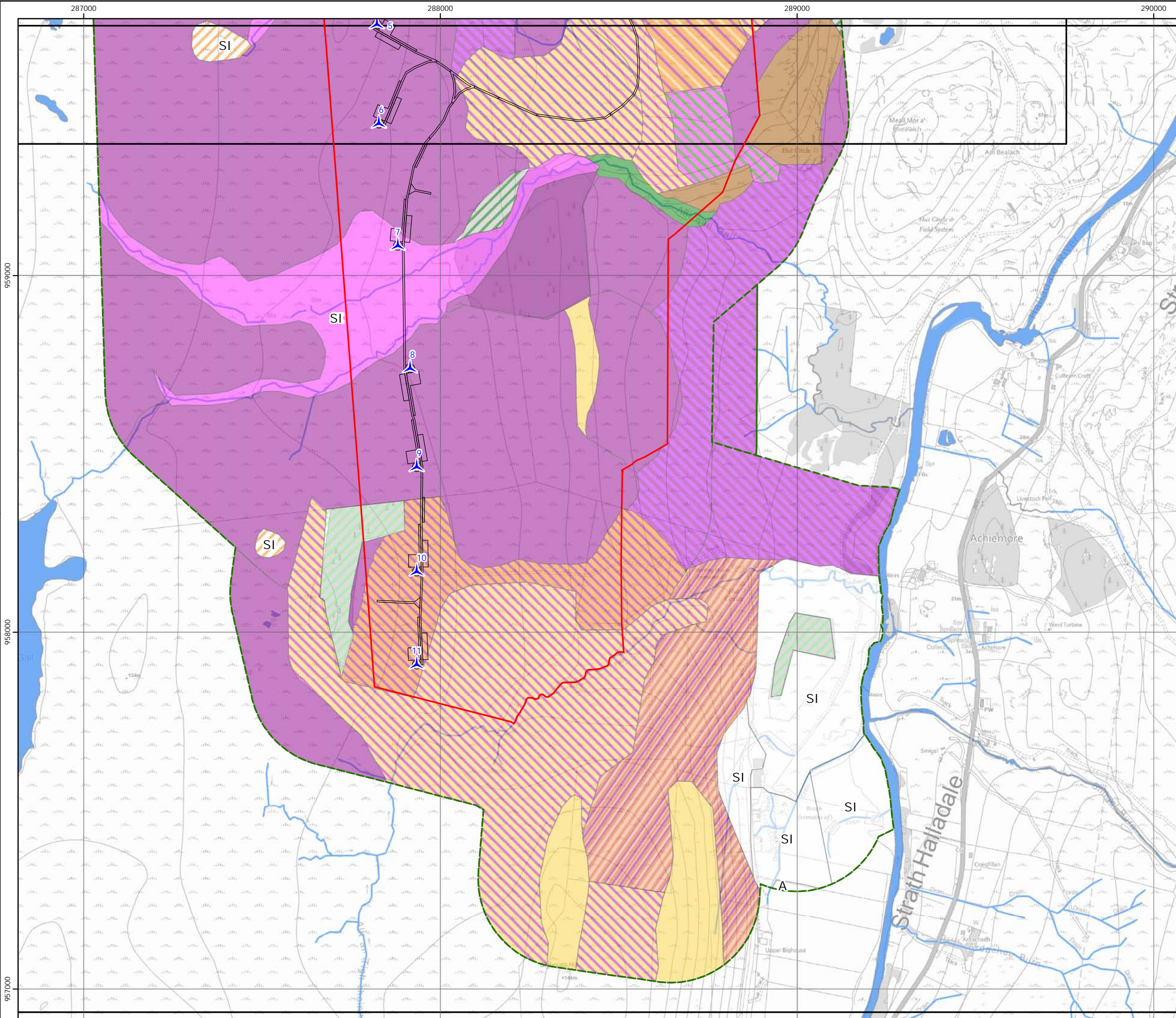
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| Acid/neutral flush / Broadleaved woodland - plantation                          | Semi-improved acid grassland / Wet dwarf shrub heath |
| Marsh/marshy grassland / Wet dwarf shrub heath                                  | Semi-improved acid grassland / Bracken               |
| Marshy Grassland (B5) / Improved Grassland (B4)                                 | Semi-improved acid grassland / Acid/neutral flush    |
| Acid/neutral flush / Dry dwarf shrub heath - acid / Bracken                     | Scattered Broadleaved trees                          |
| Marsh/marshy grassland / Acid grassland - semi-improved                         | Broadleaved woodland - semi-natural                  |
| Acid grassland - semi-improved / Marsh/marshy grassland / Wet Dwarf shrub heath | Broadleaved woodland - plantation                    |
| Acid Grassland semi-improved/ Wet dwarf shrub health                            | Coniferous woodland - plantation                     |
| Dry dwarf shrub heath - acid / Bracken  | Scrub Gorse  |
| Dry dwarf shrub health acid / Wet dwarf shrub health                            | Acid grassland - semi-improved                       |
| Wet dwarf shrub heath / Blanket sphagnum bog                                    | Improved grassland                                   |
| Wet dwarf shrub heath / Dry dwarf shrub heath - acid                            | Marsh/marshy grassland                               |
| Wet dwarf shrub heath / Marsh/marshy grassland                                  | Marsh/marshy grassland / Bracken - continuous        |
| Neutral grassland - semi-improved   | Bracken - continuous                                 |
| Cultivated/disturbed land - arable  | Dry dwarf shrub heath - acid                         |
|   | Wet dwarf shrub heath                                |
|   | Blanket sphagnum bog                                 |
|   | Flush and spring - acid/neutral flush                |

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# Kirkton Energy Park

## Kirkton Wind Farm Ltd

Figure 8.1.3  
Phase 1 Habitat Survey Results  
Map 3

**Key**

- Proposed turbine
- Proposed infrastructure
- Site boundary
- Survey area

**Phase 1 Habitats**

|   |  |
|---|--|
| Acid/neutral flush / Broadleaved woodland - plantation                          | Semi-improved acid grassland / Wet dwarf shrub heath |
| Marsh/marshy grassland / Wet dwarf shrub heath                                  | Semi-improved acid grassland / Bracken               |
| Marshy Grassland (B5) / Improved Grassland (B4)                                 | Semi-improved acid grassland / Acid/neutral flush    |
| Acid/neutral flush / Dry dwarf shrub heath - acid / Bracken                     | Scattered Broadleaved trees                          |
| Marsh/marshy grassland / Acid grassland - semi-improved                         | Broadleaved woodland - semi-natural                  |
| Acid grassland - semi-improved / Marsh/marshy grassland / Wet Dwarf shrub heath | Broadleaved woodland - plantation                    |
| Acid Grassland semi-improved / Wet dwarf shrub health                           | Coniferous woodland - plantation                     |
| Dry dwarf shrub heath - acid / Bracken  | Scrub Gorse  |
| Dry dwarf shrub health acid / Wet dwarf shrub health                            | Acid grassland - semi-improved                       |
| Wet dwarf shrub heath / Blanket sphagnum bog                                    | Improved grassland                                   |
| Wet dwarf shrub heath / Dry dwarf shrub heath - acid                            | Marsh/marshy grassland                               |
| Wet dwarf shrub heath / Marsh/marshy grassland                                  | Marsh/marshy grassland / Bracken - continuous        |
|   | Bracken - continuous                                 |
|   | Dry dwarf shrub heath - acid                         |
|   | Wet dwarf shrub heath                                |
|   | Blanket sphagnum bog                                 |
|   | Flush and spring - acid/neutral flush                |
|   | Neutral grassland - semi-improved                    |
|   | Cultivated/disturbed land - arable                   |



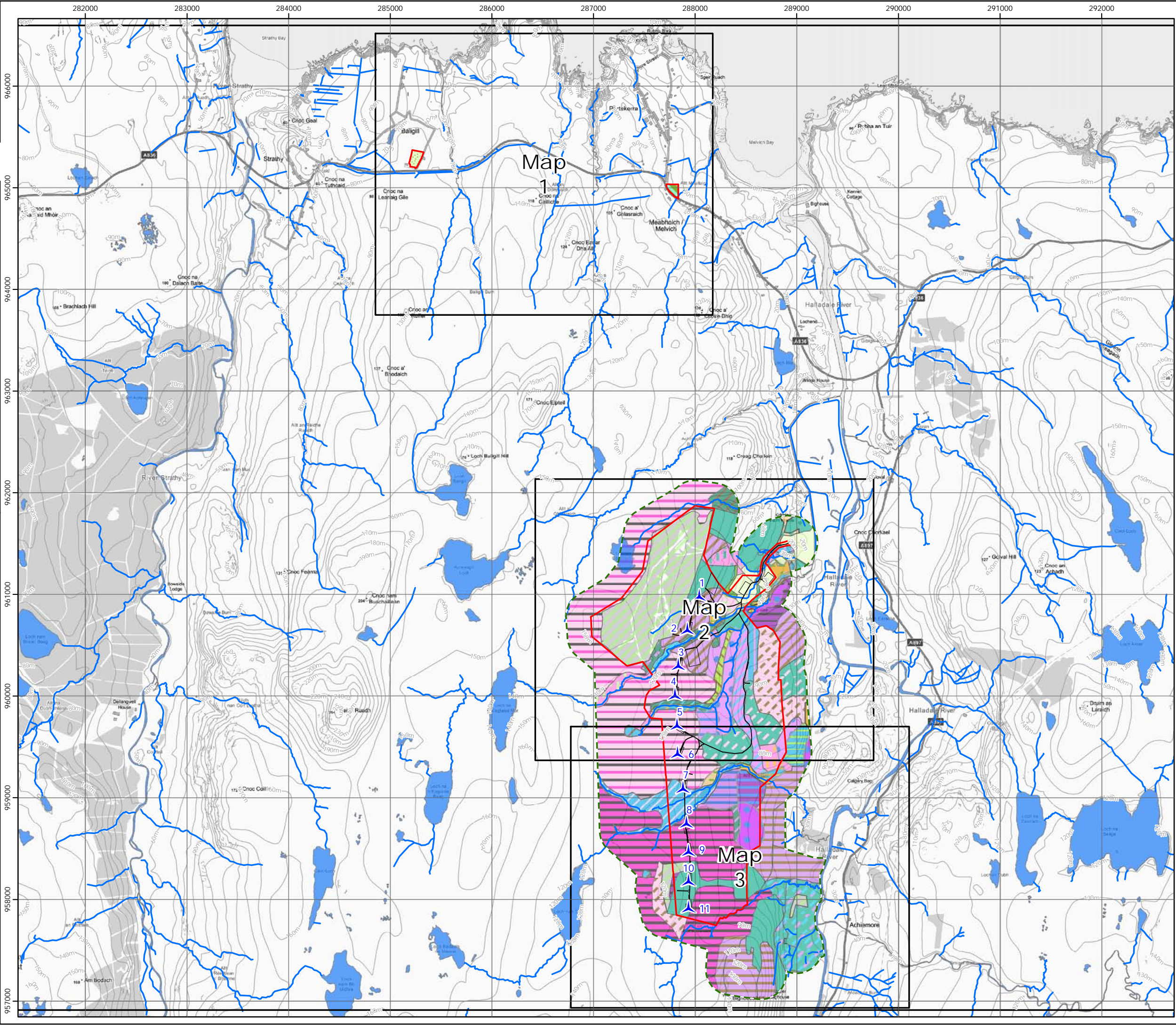
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# Kirkton Energy Park

## Kirkton Wind Farm Ltd


Figure 8.1.4  
NVC Survey Results  
- Overview

- Key**
- Proposed turbine
  - Proposed infrastructure
  - Site boundary
  - Survey area

**Dominant NVC Community**


|                               |         |
|-------------------------------|---------|
| Arable land                   | M15/M17 |
| Planted conifer               | M15-M19 |
| Mixed Woodland                | M15/H10 |
| Low woodland                  | M15/U4  |
| Improved grassland            | M17     |
| Juncus pasture                | M17a-b  |
| Pasture                       | M17b    |
| Juncus pasture/M15            | M17-M19 |
| Juncus pasture/U4             | M19     |
| Juncus pasture/U4b/U6d        | M19a    |
| H10                           | M23     |
| H10 with planted broadleaves  | M23/U20 |
| H10/M17                       | M28/U20 |
| H10/U20                       | S27     |
| H10a with planted broadleaves | U2      |
| MG6                           | U2/M6c  |
| M6a                           | U2/M15  |
| M6a-b/U4/H10                  | U2/U20  |
| M6c                           | U20     |
| M6c/W4                        | U20/H10 |
| M6c/H10/U20 low woodland      | U20a    |
| M15                           | W4      |
| M15b                          | W4c     |
|                               | W17     |
|                               | W23     |





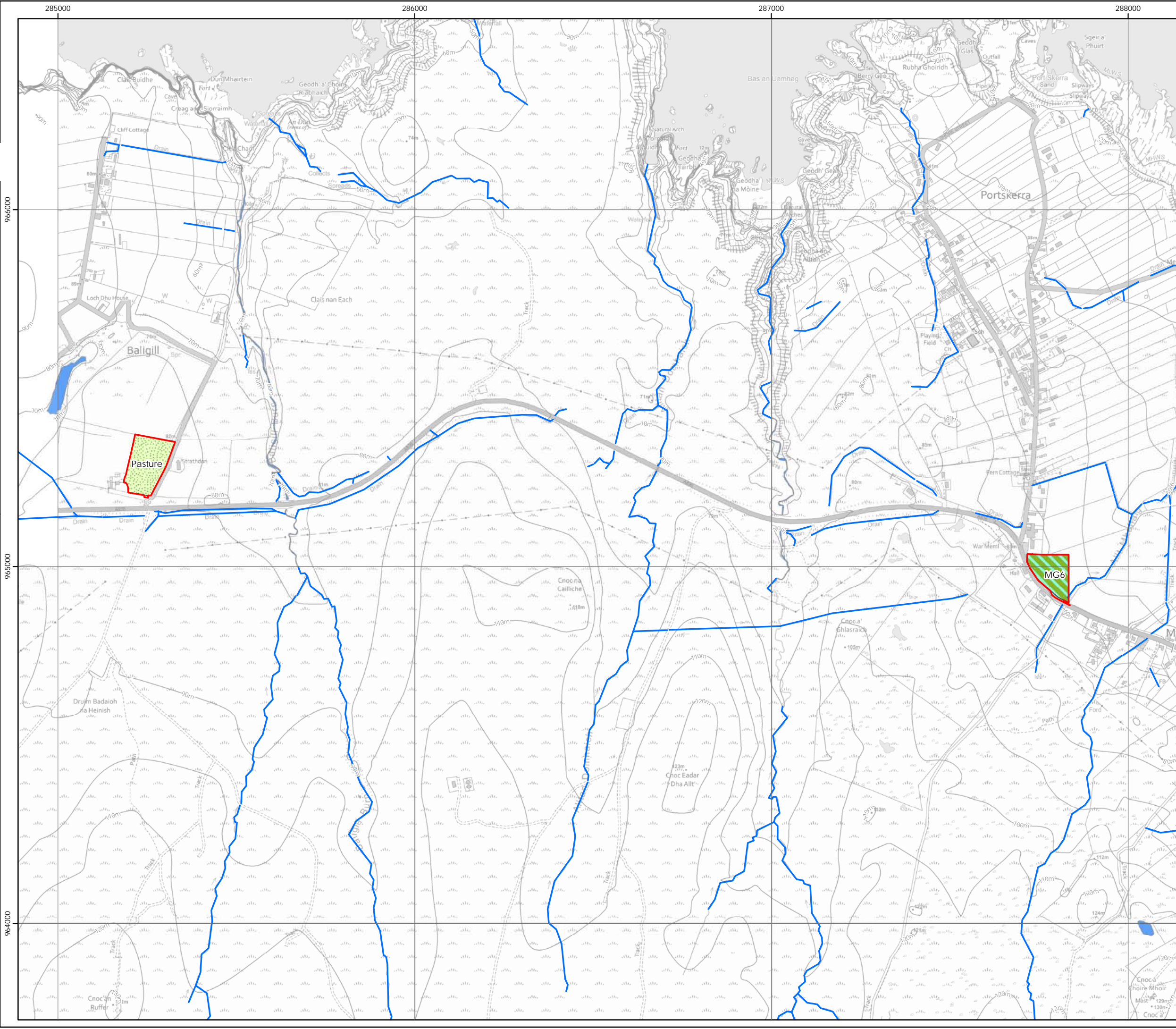
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## Kirkton Wind Farm Ltd

Figure 8.1.4  
NVC Survey Results  
- Map 1

**Key**

- Proposed turbine
- Proposed infrastructure
- Site boundary
- Survey area

**Dominant NVC Community**

|                               |         |
|-------------------------------|---------|
| Arable land                   | M15/M17 |
| Planted conifer               | M15-M19 |
| Mixed Woodland                | M15/H10 |
| Low woodland                  | M15/U4  |
| Improved grassland            | M17     |
| Juncus pasture                | M17a-b  |
| Pasture                       | M17b    |
| Juncus pasture/M15            | M17-M19 |
| Juncus pasture/U4             | M19     |
| Juncus pasture/U4b/U6d        | M19a    |
| H10                           | M23     |
| H10 with planted broadleaves  | M23/U20 |
| H10/M17                       | M28/U20 |
| H10/U20                       | S27     |
| H10a with planted broadleaves | U2      |
| MG6                           | U2/M6c  |
| M6a                           | U2/M15  |
| M6a-b/U4/H10                  | U2/U20  |
| M6c                           | U20     |
| M6c/W4                        | U20/H10 |
| M6c/H10/U20 low woodland      | U20a    |
| M15                           | W4      |
| M15b                          | W4c     |
|                               | W17     |
|                               | W23     |



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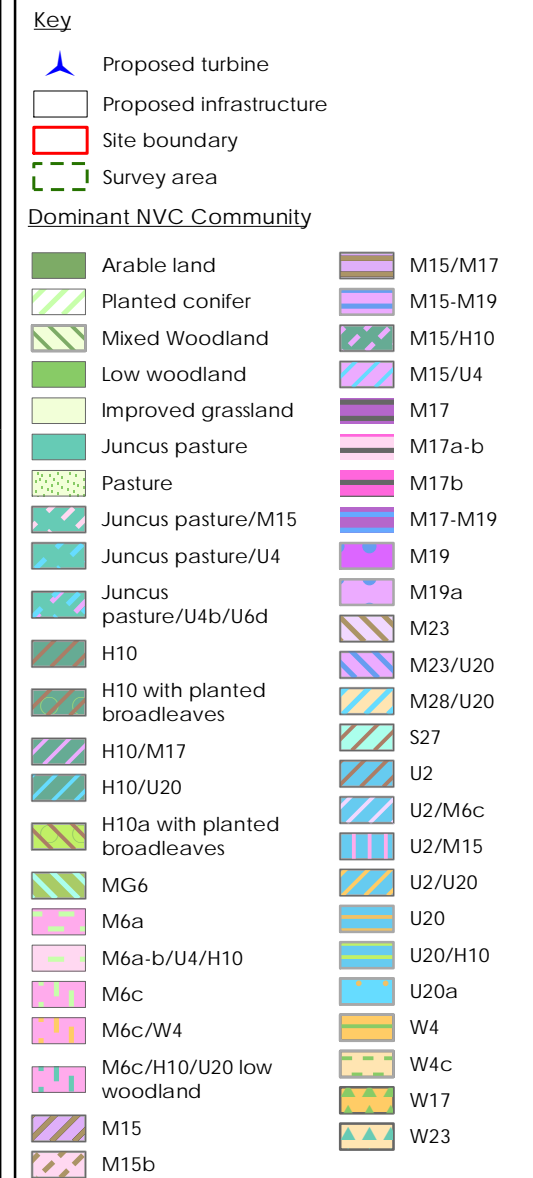
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# Kirkton Energy Park

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Figure 8.1.4  
NVC Survey Results  
- Map 2



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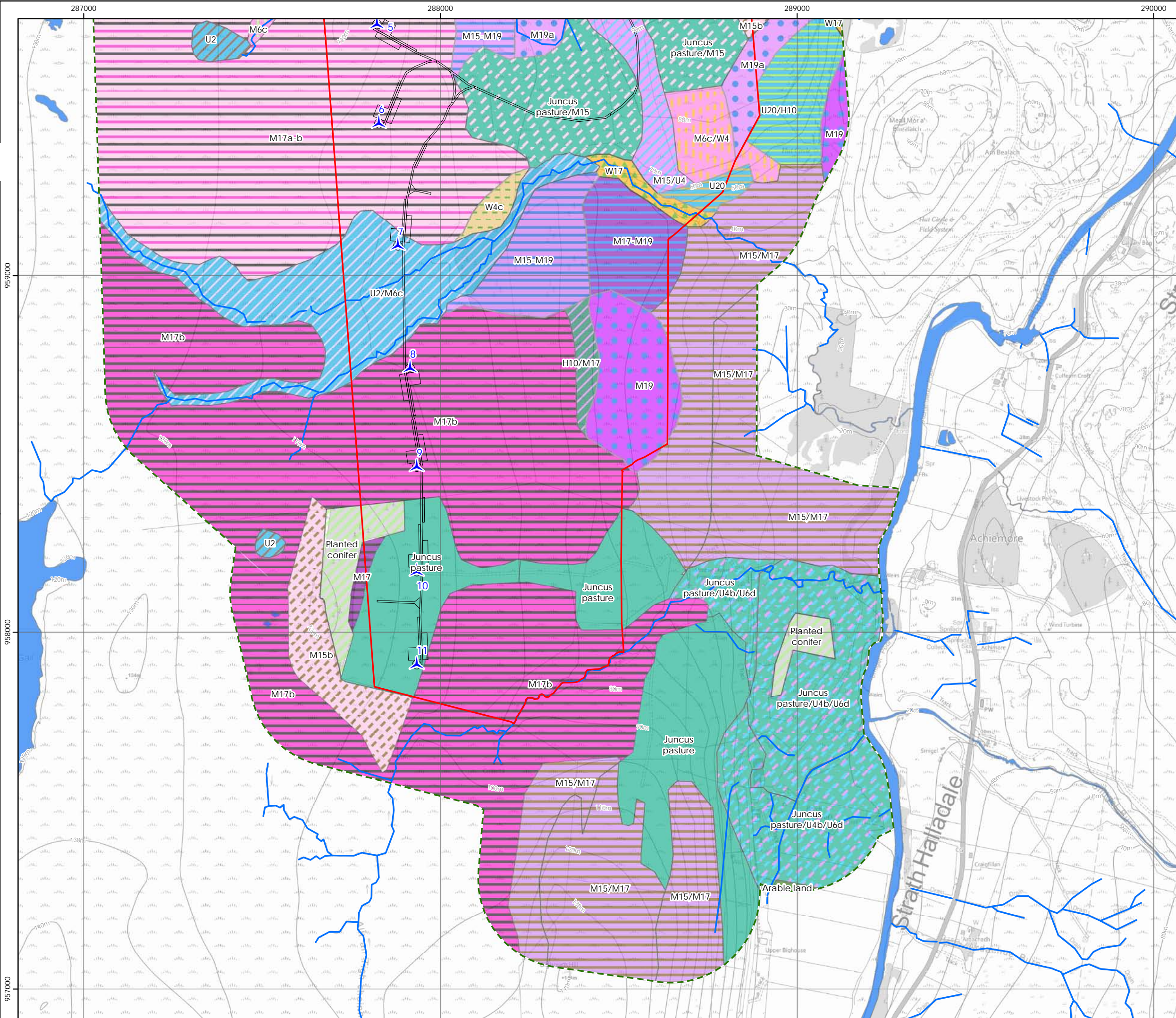
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# Kirkton Energy Park

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Figure 8.1.4  
NVC Survey Results  
- Map 3

**Key**

- Proposed turbine
- Proposed infrastructure
- Site boundary
- Survey area

**Dominant NVC Community**

|                               |         |
|-------------------------------|---------|
| Arable land                   | M15/M17 |
| Planted conifer               | M15-M19 |
| Mixed Woodland                | M15/H10 |
| Low woodland                  | M15/U4  |
| Improved grassland            | M17     |
| Juncus pasture                | M17a-b  |
| Pasture                       | M17b    |
| Juncus pasture/M15            | M17-M19 |
| Juncus pasture/U4             | M19     |
| Juncus pasture/U4b/U6d        | M19a    |
| H10                           | M23     |
| H10 with planted broadleaves  | M23/U20 |
| H10/M17                       | M28/U20 |
| H10/U20                       | S27     |
| H10a with planted broadleaves | U2      |
| MG6                           | U2/M6c  |
| M6a                           | U2/M15  |
| M6a-b/U4/H10                  | U2/U20  |
| M6c                           | U20     |
| M6c/W4                        | U20/H10 |
| M6c/H10/U20 low woodland      | U20a    |
| M15                           | W4      |
| M15b                          | W4c     |
|                               | W17     |
|                               | W23     |



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