Technical Appendix 8.8

Draft Habitat Management Plan

SCOTTISHPOWER RENEWABLES

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Euchanhead Renewable Energy Development

Habitat Management Plan

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Version 1.0 Draft

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1 Introduction

The overall purpose of the Euchanhead Renewable Energy Development Habitat Management Plan ("the HMP") is to implement positive land management for the benefit of landscape and nature conservation which will mitigate any adverse impacts that the windfarm may have had. In addition to purely mitigating against any adverse impacts, ScottishPower Renewables is also committed to enhancing the nature conservation and landscape value of the Site. As well as delivering benefits for blanket bog habitats the HMP is also likely to benefit a range of other associated species. The HMP defines the Aims and Objectives of the land management that will be implemented on site to achieve this overall purpose.

SPR has been at the forefront of blanket bog restoration, developing new techniques to restore these habitats which are effective and scalable to meet the challenges of biodiversity, climate change, water quality and natural flood management. Between 2010 and 2019 SPR has implemented 1500 ha of peatland restoration from commercial forestry across our projects. This work transcends windfarms, with the techniques now being adopted by other organisations including Forestry and Land Scotland, RSPB and NatureScot (formerly SNH) to assist with their own restoration ambitions and objectives. In 2017 SPR were invited by the IUCN to act as lead authors of a new technical report for their Commission of Inquiry into Peatlands which was published in 2019. This report describes the historical work done by SPR and other organisations to restore blanket bog from forestry, the methods which have been developed and their efficacy at achieving restoration objectives. The report can be viewed here:

https://www.iucn-uk-peatlandprogramme.org/resources/commission-inquiry/commission-inquiry-peatlands-update-2017-20

1.1 Background

Euchanhead Renewable Energy Development will comprise a maximum of 21 wind turbines up to 230 m to blade tip, an energy storage facility and associated permanent and temporary ancillary infrastructure.

The HMP was developed to describe how potential impacts the development may have on the surrounding habitat will be mitigated during the operational phase. Mitigation measures are focussed on the restoration of blanket bog habitat.

The HMP includes the following:

- A description of baseline (pre-construction) habitat conditions;
- The identification of habitat management areas including maps;
- Clear Aims and Objectives;
- Detailed methodology and prescriptions of habitat management measures, including timescales with defined criteria for the success of the proposed measures;
- Details of regular monitoring of habitat management measures using fixed quadrat locations and contingency measures should monitoring reveal unfavourable results; and
- Details of the production of regular monitoring reports to be submitted to the Planning Authority at agreed intervals.

2 Land Ownership

The land covered by the HMP is owned by the Scottish Government and managed by Scottish Forestry (SF). Upon planning consent being awarded, this land will be leased to SPR for the duration of the proposed windfarm development and the lease agreements will include a provision to enable SPR to implement management works within the area.

3 Site location and HMP Area

Euchanhead Renewable Energy Development is located predominantly in Dumfries and Galloway approximately 9.8 km south west of Sanquhar, as measured to the nearest turbine location (note one of the proposed access options to the Site from the public highway lies with the East Ayrshire). The HMP area lies within the development boundary and encompasses a total area of 23 ha. This area is entirely comprised of peatland habitat (of varying depth) and the restoration of this area is considered to compensate for the estimated 17 ha of peatland habitat predicted to be directly and indirectly lost as part of the project (Euchanhead Renewable Energy Development Environmental Statement).

4 Habitat Condition

4.1 Overview

Detailed Phase 1 habitat and National Vegetation Classification (NVC) surveys have been undertaken to support the Environmental Statement. Where potentially sensitive habitats such as blanket bog or heath were identified, further surveys were carried out to inform condition and provide more detailed information on peat depth, vegetation composition and the underlying site hydrology. Peat depth varies across the site, with the maximum depth recorded circa. 4 m. Where peat depth decreases habitats transition from degraded bog to heathland and rush mire.

4.2 Peatland habitat status

Peatland habitat across the site is generally in a degraded condition as a result of extensive historical cultivation for commercial forestry. A complete description of the impacts of forestry on peatland habitats can be found at https://www.iucn-uk-peatlandprogramme.org/sites/default/files/header-images/Resources/COI%20Forestry%20briefing.pdf.

Surviving forms of peatland habitats within the site are dominated by modified forms of NVC communities M20 *Scirpus cespitosus-Erica tetralix*, M25 *Molinia caerulea - Potentilla erecta* mire and M15 *Scirpus cespitosus - Erica tetralix*.

5 Aims and Objectives

5.1 Delivery Process

The delivery of an HMP is based on achieving the various Aims, which are assessed by measuring the extent to which clearly defined Objectives and their associated condition indicators have been met. The definition of each Objective is therefore a key requirement for an HMP to allow progress to be assessed in a quantified, objective way which has clear implications for whether the overall Aims are likely to be met and any management measures which need to be put in place or amended.

A summary of the stages is shown in **Figure 1** which has been applied to each Objective within this HMP. For Objectives where the required management is not obvious, or the processes not well enough understood to allow them to be defined in detail, a programme of trials is advocated to allow the methods, costs, rates and effects of management measures to be assessed before being implemented more widely.

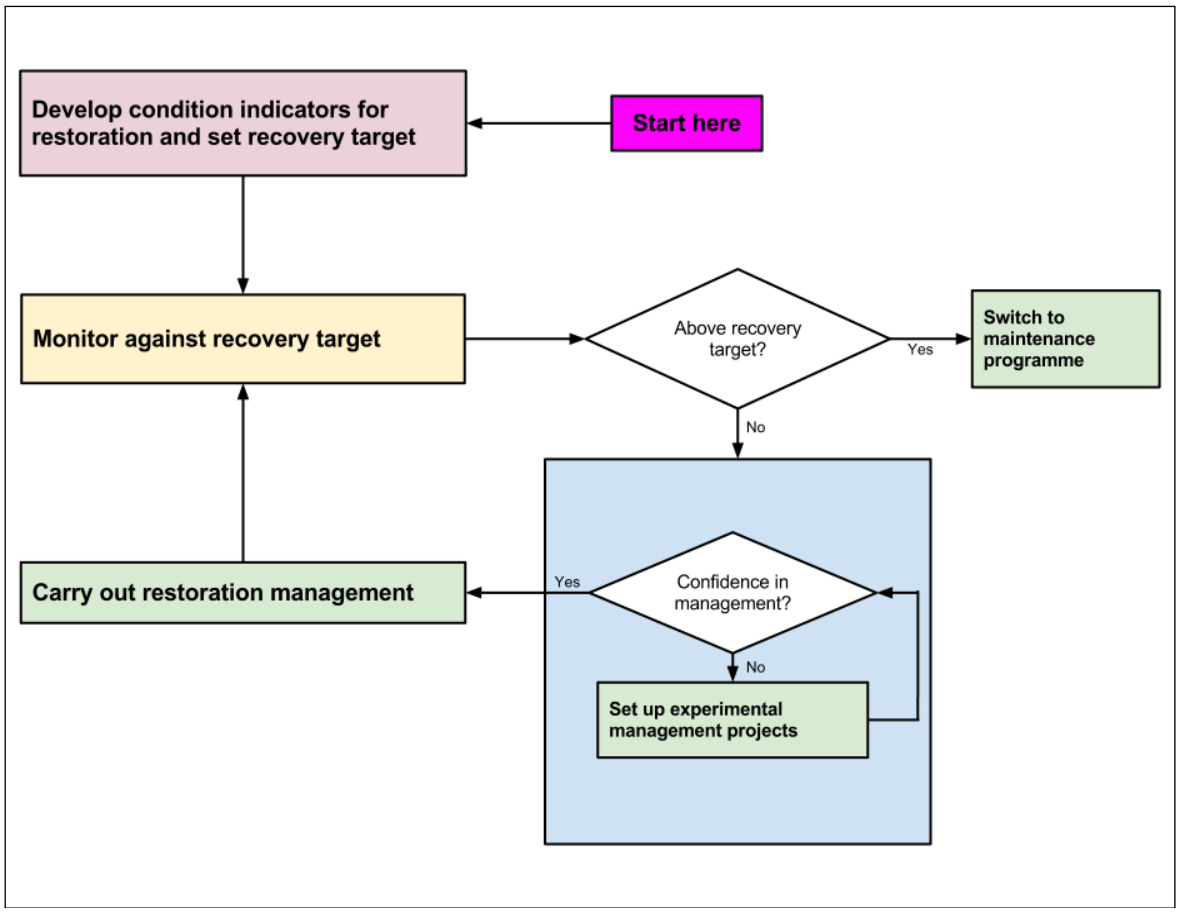


Figure 1: Process for monitoring and management to achieve habitat restoration, redrawn from Hurford and Schneider (2007).

5.2 Quantifying restoration outcomes

Some objectives are considered to be more fundamental than others to achieve in order for habitats to be restored, and have therefore been weighted accordingly (see individual Objectives within each Aim for the weighting). This allows an overall weighted average score for the entire site to be produced out of 100 and compared with **Table 1,** with 100 demonstrating each objective is met at every sample location. This method allows an overall assessment of restoration progress to be made.

Condition Class	Weighted Average Score
Very poor	<60.0
Poor	60.01-70.0
Acceptable	70.01-80.0
Good	80.01-90.0
Excellent	90.01-100

Table 1: Scoring system for HMP targets

Table 2 shows the breakdown of each individual objective along with the weighting which is based on the relative importance for the overall Aim being achieved. The highest weighting is given to bog water table as good hydrology is critical to the function of healthy bog habitat. Higher weighting is also given to the *Sphagnum* moss objectives as these are the constants of blanket bog habitat and also indicate the basic hydrology is intact.

Aim	Group	Objective	Short Description	Weighting
Aim 1: Underlying Conditions	Bog Water Table	1.1	Water table in drought: <20 cm	20 %
		1.2	Water table in drought: <10 cm	15 %
		1.3	Water table in drought: 0 cm	5 %
	Tree regeneration	1.4	Absence of trees	5 %
		1.5	Tree height	5 %
Aim 2: Conservation Status and Quality	*Sphagnum* and Peat	2.1	*Sphagnum* present	10 %
		2.2	Thick branched *Sphagnum* present	5 %
		2.3	*Sphagnum* cover >30 %	10 %
		2.4	*Sphagnum* trampling absent	2.5 %
		2.5	Bare peat cover <1 %	5 %
	Higher Plants	2.6	*Eriophorum* spp. present	5 %
		2.7	*Calluna* present	5 %
		2.8	*Calluna* >20 cm and <20 % browsed	2.5 %
		2.9	True grass cover <5 %	2.5 %
		2.10	Key plant cover <75 %	2.5 %

Table 2: Weighted score given to each objective

The score for a treated area is therefore calculated as follows:

Weighted Average Score for each habitat grouping (example for blanket mire) = Sum (% Samples which meet Obj. 1.1 * 0.20, % Samples which meet Obj. 1.2 * 0.10..., % Samples which meet Obj. 3.10 * 0.025)

Proposed management measures for each area are described in Section 6 and a description of monitoring methods is included in Section 7.

Aim 1: Restore conditions for deforested blanket mire habitat

Definition and Distribution

The definition of blanket mire habitat covered by Aim 1 is defined as all areas within the HMP boundary. These areas typically are deforested (note that where trees are currently standing these will be felled during the construction phase) with peat depth >0.5 m. This covers a total area of approximately 23 ha.

Background

The condition of bog habitat within the HMP area is poor due to excessive cultivation for commercial forestry. In order to create the underlying conditions required for the establishment of typical bog species, restoration works will need to be carried out to reverse the effects of negative historical management activities and prevent further habitat degradation.

Condition Requirements

The primary condition required to support blanket bog habitat is a water table depth which is close to the surface throughout the year, including the drought period (typically April – June). Based on this requirement, a set of Objectives have been defined which will allow restoration progress to be monitored.

Objectives

Based on the requirements specified above a set of Objectives have been defined which will allow progress to be monitored (**Table 3**). An Objective is considered to be met when at least 70 % of sample plots meet the specified criteria.

	Objective	Description	Weighting
Bog water table	1.1	The bog water table should be no deeper than 20cm from the surface of the main peat mass on each sampled plot when assessed in summer 'drought conditions' (defined as the time at which water table levels on site are considered to in the lowest 10% of their measured range, and rainfall has been negligible for at least 3 weeks; surveys undertaken any time between 1st April and 31st August).	20 %
	1.2	The bog water table should be no deeper than 10cm below the surface of the main peat mass on each sampled plot when assessed in summer 'drought conditions'.	15 %
	1.3	The bog water table should be at or above the surface of the main peat mass on each sampled plot when assessed in summer 'drought conditions'.	5 %
Tree regeneration	1.4	Conifer trees, broadleaf trees and exotic shrubs (e.g. Rhododendron) should be absent from each sampled plot.	5 %
	1.5	Conifer trees, broadleaf trees and exotic shrubs (e.g. Rhododendron) should be < 1m in height if present.	5 %

Table 3: Bog water table and tree regeneration Objectives

Aim 2: Improve quality of blanket mire habitat

Definition and Distribution

The definition of blanket mire habitat covered by Aim 1 is defined as all areas within the HMP boundary. These areas typically are deforested with peat depth >0.5 m (note that where trees are currently standing these will be felled during the construction phase). This covers a total area of approximately 23 ha.

Background

The blanket mire habitat within the HMP area has been heavily drained and is of a lower quality than would be expected on intact blanket mire. This is evidenced by the plant assemblages observed within the HMP area, which is not as diverse as would be expected from a high quality bog.

The long-term aspiration (>5 years) is to restore the blanket mire habitat within the HMP area to a high quality. Monitoring undertaken by SPR on other restoration sites has shown that once underlying conditions are restored, typical bog species will start to recolonize treated areas. The precise vegetation assemblage which would be expected is difficult to define at this stage and variation is also expected between the mesotopes present.

Objectives

A number of indicators have been used to formulate Objectives which reflect different aspects of blanket mire quality over time (**Table 4**). These will be compared against suitable reference areas where possible to allow the quality of the restored blanket mire to be assessed in context. An Objective is considered to be met when at least 70 % of sample plots meet the specified criteria.

	Objective	Description	Weighting
Sphagnum and peat	2.1	At least one species of Sphagnum should be present (open range land: predicted community M17, 18 or 19) on each sampled plot.	10 %
	2.2	*Sphagnum papillosum* or *S. magellanicum* should be present (open range land where expected type is M17 & 18) on each sampled plot.	5 %
	2.3	Sphagnum spp. should account for at least 30% of basal cover on each sampled plot.	10 %
	2.4	Visible trampling or uprooting impacts of large grazing mammals on Sphagnum hummocks (or lawns) should be absent on each sampled plot.	2.5 %
	2.5	Bare peat should comprise <1 % of 'basal' cover on each sampled plot, in situations where it is arising due to trampling effects or disturbance by machinery (where sites are naturally eroding this target can be modified to suit).	5 %
Higher plants	2.6	*Eriophorum* spp. should be present on each sampled plot.	*5 %*
	2.7	*Calluna vulgaris* should be present on each sampled plot.	5 %
	2.8	*Calluna vulgaris* of at least 20 cm average canopy height and with < 20% leading shoots browsed by deer/sheep on average, should be present on each sampled plot.	2.5 %
	2.9	'True grasses' foliar cover should be less than 5 % on each sampled plot.	2.5 %
	2.10	The combined cover of *Calluna vulgaris*, *Eriophorum* spp. and *Tricophorum cespitosum* should account for no more than 75 % of foliar cover on each sampled plot.	2.5 %

Table 4: *Sphagnum*, peat and higher plant Objectives

6 Habitat Management Measures

The habitat management measures proposed by SPR reflect the different requirements of site conditions which are variable.

6.1 Physical Interventions on degraded bog habitat

Physical interventions are defined as measures which comprise mechanical treatment to an area of land. These treatments will be carried out at an appropriate time post felling (typically >4 years after felling).

SPR have undertaken several trial projects to investigate types of intervention and associated costs, environmental risks and practical considerations relevant to forest-bog restoration. A description of the work undertaken and results are detailed at https://www.iucn-uk-peatlandprogramme.org/sites/default/files/header-images/Resources/COI%20Forestry%20briefing.pdf with a summary included in **Table 5** below.

Technique	Description	Drain/furrow disruption	Conifer regeneration removal
Cross-tracking	Uses a tracked excavator to flatten plough ridges and disrupt drainage pathways and ring-bark conifer regeneration	Yes	Yes
Ground-smoothing	Uses an excavator bucket to upturn stumps and infill furrows and drains and bury conifer regeneration	Yes	Yes
Hand clearance	Hand felling of conifer regeneration using clearing saws or chainsaws	No	Yes (densities <2500/ha)
Wave damming	Creating dams approx. 4m apart within existing drains and double ploughed furrows to stop water flow.	Yes	No
Raking	Uses an excavator to rake conifer regeneration into brash piles	No	Yes

Table 5: Physical intervention methods

The precise areas where each technique will be implemented will be determined when undertaking the detailed planning of restoration work. It is envisaged that a combination of measures will typically be required within each defined area depending on ground conditions, topography and the extent of factors affecting restoration (i.e. conifer regeneration, ploughing method, stump sizes, drain status etc.).

7 Monitoring

SPR has developed a protocol to monitor vegetation in relation to the Objectives set out within the HMP based on extensive experience monitoring similar habitats across Scotland.

Monitoring will be undertaken on a set of permanent 1m radial samples within the HMP area. At each 1m radial sample point the following information will be collected for species relevant to the Objectives (target species):

1. Presence/absence of target species
2. By eye cover targets of key metrics (see 2a below)
3. Height and offtake of *Calluna*
4. Depth to water table (using fixed dipwell)
5. 3 pin hits of foliar and basal vegetation cover equally spaced along a 20 m transect (long format only)

There are two monitoring methods used: a long monitoring protocol and short monitoring protocol. The short monitoring protocol only records items 1, 2, 3 and 4. The protocols will be applied according to the programme below. See Appendix 1 for further details on the monitoring protocol.

Year	**1**	**2**	**3**	**4**	**5**	**7**	**9**	**12**	**15**	**20**	**25**
Method	Long	Short	Long	Short	Long	Short	Long	Long	Long	Long	Long

Appendix 1: Field Monitoring Protocol

Frequency Assessment

At each monitoring sample plot a rope demarcated at 0.25 m, 0.50 m and 1 m will be used to form a radial quadrat. Starting with the smallest distance and working up to 1 m, the presence of each target species is to be recorded, noting the smallest distance found. This nested unit size allows different sizes of sampling units to be applied to species of differing abundances for trend monitoring i.e. common species are assessed in smaller units and rarer species are assessed in larger units.

General Cover Assessment

a) Record each by eye cover assessment within each frequency point (1m circle):
   i) is *Sphagnum* cover > 30 % (if unsure record lower)
   ii) is bare peat cover < 1 % (if unsure record higher)
   iii) is true grass cover (excluding *Molinia*) < 5 % (if unsure record higher)
   iv) is the combined cover of *Calluna, Eriophorum* and *Tricophorum* < 75 % (if unsure record higher)

***Calluna* height and offtake**

Record the height of a representative *Calluna* plant within each 1 m radial plot. Record *Calluna* height from top of the basal layer the depth of the basal layer to peat surface separately. Record the percentage of *Calluna* long shoots browsed.

Dipwell protocol

Permanent dipwells will be installed at each monitoring sample plot. During a drought period where there has been no limited rainfall in the preceding 14 days (typically between April and June, although can occur at other times), the dipwells will be measured by measuring from the top of the dipwell to the water table (termed “water depth”), and from the top of the dipwell to the main peat mass surface (termed “peat offset”). By subtracting the peat offset from the water depth it is possible to calculate the true value of the water table within the bog.

Pin hits

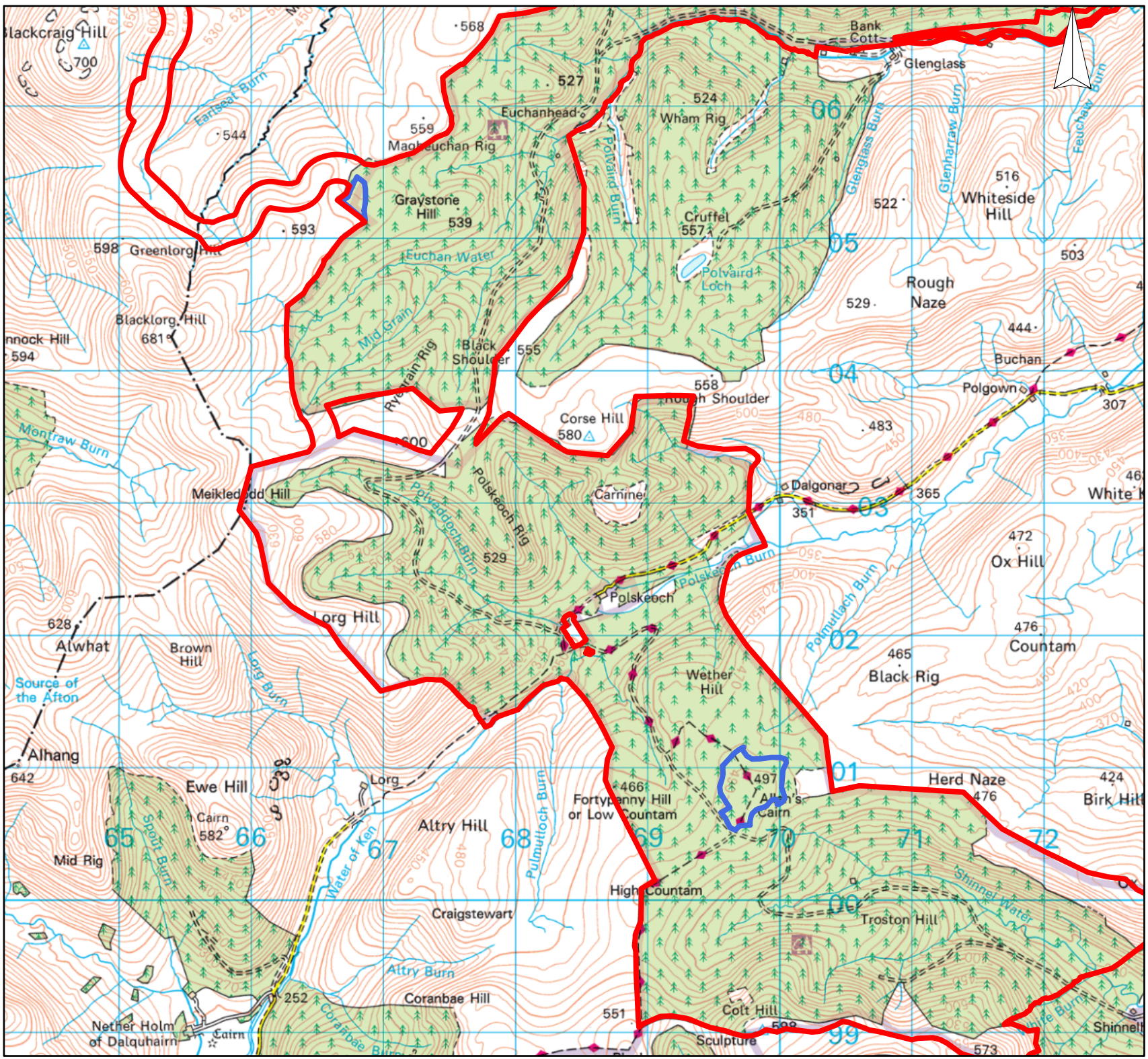
At each monitoring sample plot a rope demarcated at 1 m, 11 m and 19 m is set out to the west. At each marker point a laser pointer is stood on the north side of the rope and used to record any living plant species, plant litter or bare peat that it hits directly below. Both basal layer and higher vegetation are to be recorded.

Long and Short Monitoring Methods

The ‘long’ monitoring method records the following information:

1. Presence/absence of target species
2. By eye cover targets of key metrics (see 2a below)
3. Height and offtake of *Calluna*
4. Depth to water table (using fixed dipwell)
5. 3 pin hits of foliar and basal vegetation cover equally spaced along a 20 m transect (long format only)

The ‘short’ monitoring method is the same as above with the omission of pin hits of foliar and basal vegetation cover.



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Legend

Application Boundary

HMP Area

Scale: 1:38000 @ A4

Status	Date	Dr.	Ch.	Apj
FINAL	Oct 2020	RS	PR	PR

Habitat Management Plan Area

Euchanhead Habitat Management Plan	Map 8.8.1

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