# Slamannan Bog Restoration Project

## *Year 1 Report*

23rd November 2015

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***Saving the small things that run the planet***

## CONTENTS



**Left: Bog vegetation in monitoring quadrat. Centre: Installing piling dams. Right: Common hawker dragonfly egg-laying in bog pool**

**SUMMARY**

The Slamannan Bog Restoration Project began in September 2014 with the aim of restoring at least 150 hectares (ha) of degraded raised bog habitat in the Slamannan Plateau. The project is focused on an area of peatland called Fannyside Muir, 3km from Cumbernauld.

The project is managed by Buglife Scotland in partnership with landowners Forestry Commission Scotland (FCS), North Lanarkshire Council (NLC), Scottish Wildlife Trust (SWT) and additional stakeholders Royal Society for the Protection of Birds (RSPB) and Scottish Natural Heritage (SNH).

The production of a Management Plan and the work associated with the restoration of bog habitats at Fannyside Muir has been funded by WREN grant BAF14 - 'The Slamannan Bog Restoration Project' and through contributions of the European Union to the EcoCo LIFE+ project LIFE13 BIO / UK / 000428 '*Implementation of integrated habitat networks to improve ecological coherence across the CSGN'.* This work was supported by SNH as part of the Peatland Action project and contributes to Scotland's National Peatland Plan and North Lanarkshire Council's Bog Action Plan.

Progress in the first year of the project is summarised below:

- Production of Management Plan '*Fannyside Muir Bog Restoration Project: Management Plan, 2015-2024' w*ith detailed objectives and prescriptions for the management of the core 150 ha of the site, for the next 10 years.
- Habitat Regulations Assessment of proposed works carried out by SNH based on management plan and a detailed document prepared by RSPB Scotland to help inform the Habitat Regulation Assessment. Written consent from SNH giving the go ahead for restoration work to begin was obtained on the 11th August 2015 (Verbal consent given at the end of July).
- Openspace (Cumbria) Ltd began restoration work at Fannyside Muir on the 12th of August, following a public tendering process. All work was completed by the 15th September. Deadline for completion of all works was 20th. This is the earliest date that over-wintering Taiga bean geese have returned to the Slamannan Plateau.
- During 2015 910 peat dams and 90 reinforced plastic piling dams were installed across ~110 ha of the site to raise and stabilise ground water levels on the bog.
- A 670 m long trench bund was installed parallel to Fannyside Road to help retain more water on the bog (as a replacement for failed cross-tracking technique).
- Scrub and regenerating conifers (approx.0.6 ha) were removed from the site entrance area. Volunteer work parties have cleared scrub from the railway bund.
- Two new bog pools of 25m x 25m in size were created as potential roosting habitat for Taiga bean geese and other wildlife.
- Network of 32 hydrological monitoring dipwells were installed across the site to complement groundwater loggers that were installed in September 2014. Significantly raised ground water levels were recorded in restored areas.
- Monitoring of the site included 7 fixed vegetation monitoring quadrats, 32 mini vegetation quadrats, specialist breeding bird and protected species surveys, reptile surveys, moth trapping, butterfly timed counts, aquatic invertebrate surveys and a variety of other invertebrate surveys.
- Fixed point photography and aerial photographs of the site were taken.
- A total of 478 species were identified within the core project area during the first year.

Plans for further work in 2016 are discussed.

## 1. Introduction

This report summarises the first year of progress in delivering the aims of the Fannyside Muir Bog Restoration Project Management Plan through a set of agreed and prioritised objectives and prescriptions.

**MANAGEMENT AIM**

***To restore bog activity across Fannyside Muir and improve ecological coherence of Fannyside Muir with the wider Slamannan Plateau.***

**The long term aims are to:**

1. **Restore bogs in the Fannyside Muir area**
2. **Secure the favourable management of lowland raised bogs for wildlife**
3. **Support the delivery of the North Lanarkshire LBAP and Scottish Biodiversity Strategy**
4. **Protect and if possible enhance habitat for the Slamannan Plateau SSSI & SPA designated features**
5. **Enhance ecological coherence of Fannyside Muir with the wider Slamannan Plateau**
6. **Build knowledge of all biological taxa at the site**
7. **Raise public awareness of the importance of peatlands**

The production and implementation of the site management plan is a partnership between Buglife Scotland (BS), Forestry Commission Scotland (FCS), North Lanarkshire Council (NLC), Scottish Wildlife Trust (SWT), Royal Society for the Protection of Birds (RSPB) and Scottish Natural Heritage (SNH).

The management plan and work associated with the restoration of bog habitats at Fannyside Muir has been funded by WREN grant BAF14 - 'The Slamannan Bog Restoration Project' and through contributions of the European Union to EcoCo LIFE+ project LIFE13 BIO / UK / 000428 '*Implementation of integrated habitat networks to improve ecological coherence across the CSGN'.* This work is supported by SNH as part of the Peatland Action project and contributes to Scotland's National Peatland Plan and North Lanarkshire Council's Bog Action Plan.

## 2. Background

There has been a dramatic decline in the area of lowland raised bogs in the past 200 years. In Scotland, it is estimated that the original 28,000 hectares (ha) of raised bog habitat has now diminished to under 5,600 ha - a loss of 80% (*EC Habitats Directive Annex 1 Habitats from UK 2013 reporting.* http://jncc.defra.gov.uk/page-6392.). Most of the remaining raised bog habitat in Scotland is located within the Central Belt and is threatened by detrimental land management activities. Historically the greatest decline has occurred through agricultural intensification (drainage), afforestation and commercial peat extraction. Future declines are likely to be the result of the gradual desiccation of bogs which are hydrologically fragmented from each other and damaged by previous attempts at drainage.

Scotland's peatlands and raised bogs are internationally important habitats for wildlife and plants including moorland birds, insectivorous sundews (*Drosera* sp.) and invertebrates such as the Large heath butterfly (*Coenonympha tullia*), a bog–specialist that has suffered population declines across Europe, due to loss of bog habitat.

Peat soils in Scotland contain almost 25 times as much carbon as all other soils in the UK. The carbon stored in Scotland's soils (notably peat and peaty soil) is equivalent to over 180 years of greenhouse gas emissions from Scotland at current emission rates.
Healthy peatlands keep carbon locked up, and continue to absorb more carbon. Degraded bogs emit carbon dioxide and other greenhouse gasses, which contribute to climate change. Restoring peat-forming habitat that has previously been damaged ensures that the bog remains as a long-term carbon sink and significantly reduces greenhouse gas emissions.

Raised bogs also help maintain the quality of water by absorbing atmospheric pollutants and retaining carbon, which can significantly pollute streams downstream of degraded bogs. Healthy bogs function as sponges, regulating and slowing the movement of rain water which helps to prevent flooding.

### Fannyside Muir

Fannyside Muir lies approximately three kilometres east of the town of Cumbernauld in North Lanarkshire. The project site lies just north-east of Palacerigg Country Park and north of Fannyside Loch. ( See Map 1).

Fannyside Muir comprises of a mix of peatland habitat types, including blanket bog, lowland raised bog and intermediate bog types. The area has been subject to historic, wide-ranging and long-term adverse management including drainage to facilitate commercial peat extraction and afforestation. A significant proportion of the restoration project site is within the boundaries of the Slamannan Plateau Site of Special Scientific Interest (SSSI) and Special Protection Area (SPA). These areas were designated for the nationally important population of Taiga bean geese (*Anser fabalis fabalis*) which visit the Slamannan Plateau in winter. The project site falls within the Cumbernauld Living Landscape boundary, which is a landscape scale conservation programme lead by the Scottish Wildlife Trust, North Lanarkshire Council and Forestry Commission Scotland.

This project is needed to restore areas of the designated site to improve the overall peatland functioning and coherence of the plateau area. This project will build on bog restoration work previously undertaken by North Lanarkshire Council on a small area of Fannyside Muir that established the restoration potential of bogs in this area.

## 3. Progress with Management Objectives and Prescriptions in Year 1

The Fannyside Muir Bog Restoration Project Management Plan describes a set of objectives and prescriptions required to achieve the overall management aim:
***To restore bog activity across Fannyside Muir and improve ecological coherence of Fannyside Muir with the wider Slamannan Plateau.***

This section reports on progress in achieving each of the management objectives through the prescriptions listed for each one. Management objectives and prescriptions have been divided into the following categories: **A: Habitat Management; B: Monitoring, Survey and Research; C: Public Engagement and Promotion; and D: Administration.**

**Management Objectives:**

**A: Habitat Management**

**Objective 1:**
**To re-wet the bog and establish bog vegetation in areas currently lacking bog species**

**Rationale:**
Large areas of Fannyside Muir have been subjected to historic drainage to facilitate either commercial peat extraction or afforestation. Drainage has the effect of lowering water table levels, drying out the peat and inhibiting the growth of peat-forming *Sphagnum* sp. Waterlogged, anoxic conditions inhibit the decomposition of peat, locking carbon in the peat for thousands of years, however once the peat is drained, aerobic decomposition begins and huge volumes of carbon dioxide and methane can be released. Over time, some drainage ditches may occlude with vegetation, which slows the removal of water and may eventually lead to the reestablishment of Sphagnum and restoration of bog activity. However, this process can take decades and without intervention further drying, afforestation and loss of bog-specialist flora and fauna is more likely.

Installing dams on active drainage ditches will help raise and stabilise water table levels throughout the year and encourage recolonisation of bog vegetation. Plastic piling dams or peat dam dams can be used depending on the size, slope and activity of the drain. Large, active ditches are considered a priority for dam installation, while heavily occluded drains with low activity are considered a low priority. Once dammed, open water retained in ditches can be subject to evaporation. A number of methods have been used in the past to reduce evaporation and fluctuations in water level such as adding straw bales, brash, or bundles of heather harvested from the site. Partially infilling ditches or reprofiling the sides of steep-sided large ditches to make them shallower can increase the rate of ditch-colonisation by Sphagnum and other bog vegetation.

Despite 18 years having passed since commercial peat milling ceased at Fannyside Muir, areas of bare peat as still evident across the site due to the peat surface becoming water-logged in winter and then drying out in summer.
Good quality bog vegetation is present in a variety of areas across the restoration site and by improving hydrological connectivity across the entire site these can be encouraged to spread and recolonise degraded areas.

Variations in local micro-topography left by peat milling and ploughing prior to conifer planting can act as a significant barrier to colonisation of bog plants. Highpoints are generally too dry in summer, while low points can be too wet for suitable plants to colonise.

Tracking across areas of the bog surface using a tracked excavator can help smooth/ level-out these variations and promote bog vegetation establishment.

Broadleaf scrub and regenerating conifers should be removed as they increase nutrients, damage the bog surface and further dry out the bog. Scrub was removed either by contractors using chainsaws or excavators with mulching heads depending on the size of the trees, or by volunteer work parties using hand tools. Broadleaf stumps will be carefully treated with herbicide to prevent re-growth in line with Scottish Natural Heritage specifications. All work with pesticides and machinery including excavators, brush cutters and chainsaws was carried out by experienced contractors to avoid any damage to the peat moss surface and complied with FC and FISA guidance.

All of the work within the SSSI and SPA was undertaken with the agreement of Scottish Natural Heritage following an appropriate Habitat Regulations Assessment. Whilst much of the work was carried out by specialist contractors, there were a number of volunteer work parties involving local people helping to clear scrub across the site.

All of the restoration actions discussed here were carried out with the aim of re-wetting the bog, but they will also help to protect, or enhance habitat for existing SSSI and SPA designated features of the bog (see Objective 2)

**Prescriptions:**

**1.1 Ground reprofiling with low ground pressure machine**

In early August 2015 the restoration contractors made an attempt to level-out variations in micro-topography of the peat-milled strips in compartments 8 and 13a. It was hoped that by tracking across the ridges with a low ground-pressure excavator this technique would improve local hydraulic gradients and help to promote bog vegetation colonisation. This technique has been used successfully on restored plantation sites, but the effectiveness on milled sites with various micro-topography ridges and features was not known. The initial trial involved tracking 3 excavators (7.5 tons with 700mm tracks) along a wide ridge of drained peat in compartment 13a. This had almost no effect other than flattening vegetation. Investigation revealed the presence of slit drains in many of the raised strips in this compartment that had significantly dried out the peat surface. Other ridges in compartment 13a were found to be exceptionally soft and made of piles of loose peat that were too narrow to support the width and weight of the excavators without the support of bog mats (thick wooden boards).

When it became clear that cross-tracking would have only limited effectiveness in compartments 8 and 13a, other techniques were considered. A 670m long trench bund (approximately 2m deep and 1.5m wide with a 0.5m high ‘bund ridge’ on the surface) was installed to block the main ditches and the narrow slit drains in the ridges of compartment 13a. The trench bunding technique involves digging down approximately 2m with an excavator bucket, churning the peat and then compressing it with the bucket to create an underground ‘wall’ of dense peat. A cap of peat and bog vegetation is then placed on top of the trench bund to hold surface water, but the main goal is to block the sub-surface slit drains and hidden cracks in the dried peat ridges, and thereby retain more water in the bog. A series of peat dams along secondary ditches in compartment 8 were also installed to slow the movement of water and encourage sphagnum growth. (See Figure 1).

### 1.2 Dam installation

Drainage ditches across the project area were blocked using a combination of recycled plastic sheeting and peat dams to retain water on the site. This will help increase the summer water table on the site to stimulate the recovery of bog-forming sphagnum species. The number and size of ditches varies on each of the bog compartments, thus the frequency and depth of dams required also varied across the site. (see Figures 2, 3 and 4).

#### 1.2.1 Plastic piling dams

Approximately 2,220 m of plastic piling was utilised in 90 dams installed across the restoration site in 2015. The use of plastic piling was kept to a minimum, but was required at the ends of long runs of peat dams and on wide or steeply inclined ditches where peat dams would likely wash out. Plastic piles of between 1.5 m and 4 m were used depending on the depth of ditches, with the majority being of 3m length. The majority of the piling dams were reinforced by timber bracing and supports where the ditch is wide or on an incline. The extent of plastic piling dam installation in the second year, and subsequent years will be informed by how the site responds to the initial phase of damming. Volunteer work parties in autumn/winter 2015 have helped to extend the width of a number of plastic piling dams to improve their water-holding potential. (See Figures 3 and 4).

#### 1.2.2 Peat dams

A total of 910 peat dams were installed on primary drains and a number of secondary drains during August and September 2015. Each peat dam is associated with a borrow-pit pool of approximately $4m^2$ in size. This resulted in a significant increase in standing bog pool habitat, and almost immediately Common hawker (*Aeshna juncea*) and Black darter (*Sympetrum danae*) dragonflies were observed utilising this new resource to lay their eggs (despite the lack of aquatic vegetation). This is a greater number of peat dams than was initially planned for this year, and arose following discussions with the contractor when it became evident that cross-tracking would not be effective in restoring compartments 8 and 13a. Plastic piling dams were installed at the ends of runs of peat dams, and these were generally also backed with a peat dam for added strength. The extent of peat dam installation in subsequent years will be informed by how the site responds hydrologically to the initial phase of damming. (See Figure 2).

#### 1.2.3 Reprofiling the sides of large ditches

A low ground pressure excavator was used to reprofile a 470m section of the steep-sided 2-3 m deep ditch that runs along the northwest boundary of compartments 7, 8 and 13a. During this procedure a 2m strip of surface vegetation on either side of the original ditch was removed and placed aside, then the ditch walls were reprofiled by partially collapsing the sides of the ditch to make them wider and shallower, additional excavator buckets of peat were ‘borrowed’ from further up the ditch to raise the ditch level further, then the strips of surface vegetation were restored to reduce erosion and promote drain occlusion. Peat dams were also installed at intervals along the length of the now shallower ditch. (See Figure 5).

#### 1.2.4 Reducing water evaporation from ditches with bundles of cut heather

This activity was not carried out during 2015, but will hopefully be carried out in 2016. Contractors will cut and bundle *Calluna*, which is abundant across the bog. Bundles of heather, along with conifer brash will be added to blocked ditches containing open water to slow down evaporation and increase the rate of ditch occlusion and Sphagnum colonisation.

### 1.3 Scrub removal

#### 1.3.1 Felling and treatment of broad leaf scrub

During August and September scrub trees and gorse growing in the vicinity of the car park area (approximately 0.6 ha) were mulched by contractors using an excavator with a mulching head. It was not considered necessary to herbicide treat the remaining macerated stumps, however any regeneration of gorse or birch will be treated in 2016. During September and October 2015, volunteer work parties helped clear a path along part of the railway bund by removing gorse, broad leaf scrub and young spruce. During 2016 contractors and volunteer work parties will remove further scrub and conifer regeneration growing on the bog. Regular monitoring of scrub regeneration will be undertaken (see prescription 3.4.2), which will help inform the frequency of follow-up work.

#### 1.3.2 Hand pulling of small broadleaf scrub with volunteers

Compartment 1 has the greatest density of birch scrub within the core restoration site. This area will be the focus of volunteer work parties in 2016, where volunteers will hand-pull or use a tree puller to remove small broadleaf saplings. If too large to pull up, a GPS device will be used to record the location and the contractor will be notified for felling and treatment with herbicide in 2016.

**Objective 2:**

**To protect, or enhance habitat for existing SSSI and SPA designated features of the bog.**

**Rationale:**

The Slamannan Plateau SSSI and SPA are both designated for winter visiting Taiga bean geese which roost on pools and surrounding peatland within compartment 11 of the restoration area. The bean geese are generally present in the area between October and February. Management objectives for the SPA state that it is essential to avoid deterioration of the bog habitats for the qualifying species and to ensure that the distribution and extent of habitats supporting the species and the structure, function and supporting processes of the habitats are maintained.

Protecting the designated features and ensuring that the geese continue to use the site is essential. Bean geese are intolerant of disturbance, choosing open areas with unobstructed lines of sight for both feeding and roosting.

As a consequence of bog restoration management work, increasing water-retention across Fannyside Mur in winter may provide additional winter roosting pools beyond those currently used by the bean geese. Additional methods to enhancing roosting habitat for geese were considered as part of the management plan.

A report to help inform an appropriate assessment of the proposed restoration measures was prepared by RSPB Scotland. This report: '*Information to Inform an Appropriate Assessment of Proposed Peatland Restoration Measures on the Slamannan Plateau SPA*' is included in Appendix VI of the site management plans, and was used by SNH, in conjunction with the management plans to undertake a Habitat Regulations Assessment of the proposed interventions. The assessment concluded beyond all reasonable scientific doubt that the restoration work will not lead to additional disturbance or displacement of the bean geese, or impact on the population as a viable component of the SPA. It also concluded beyond reasonable scientific doubt that the restoration process would not adversely change the structure, function or supporting process of habitats supporting the bean geese.

**Prescriptions:**

**2.1 Enhancing habitat for roosting Taiga bean geese at Fannyside Muir**

During the first phase of restoration work in August and September 2015, 2 new shallow (0.5m deep) 25m x 25m scrapes were excavated in the Compartment 10 to the north-west of the current roosting pools in Compartment 11. The removed peat was then used to block drainage channels nearby. Once filled with rainwater, these pools may potentially be used as additional goose roosting habitat, as well as providing breeding habitat for amphibians and aquatic invertebrates. (See Figure 6)

**2.2 No restoration work with heavy machinery to occur while Taiga bean geese present on the site.**

Contractors tendering for the first phase of restoration work at Fannyside Muir in 2015 were made aware that the deadline for work using heavy machinery within the SPA/SSSI would be the 20th September, which is the earliest date that wintering Taiga bean geese have been recorded on the Slamannan Plateau. Additionally all site infrastructure such as welfare units had to be removed from the car park area by the 25th of September. In spring, work with machinery within the SSSI/SPA will only occur after the last Taiga bean goose has left. The 4th of March is the latest date that Taiga bean geese have been recorded on the Slamannan Plateau.

Manual ditch blocking and the hand-clearance of scrub and conifers using hand tools will be possible all year round. However, from 21st September through to the 15th March, such activities will be restricted to between 1 hour after sunrise and 1 hour before sunset to avoid disturbance to geese moving between their roosting and feeding sites.

Following sign off of the site management plans and the Habitat Regulation Assessment in late July 2015, a window of approximately 7 weeks was left to complete all planned works. The successful contractor OpenSpace (Cumbria) Ltd, arrived on site on the 12th August and all contracted activities were complete by the 14th September. All machinery and infrastructure had been removed from the site by midday on the 15th September.

**2.3 Restoration work to avoid areas containing winter roost pools used by Taiga bean geese.**

No restoration work using heavy machinery is to be undertaken in the immediate vicinity of the roosting pools in Compartment 11 that are used by the Taiga bean geese. The contractor was supplied with maps to indicate which areas were off-limits to tracked machinery, and during the site induction all work crew were made aware of this.

**2.4 Restoration work infrastructure and machinery removed from site while geese are present**

Machinery and infrastructure such as a site office and diggers was to be removed from the site before the 25th September and not returned until the 15th of March to prevent any potential disturbance or change to sight-lines of any wintering bean geese that might be present on the site. All machinery and infrastructure was removed from the site before midday on the 15th September 2015.

**2.5 Use of heavy machinery and equipment on the site**

Routes for tracked machinery to follow across the bog surface were agreed prior to work commencing to minimise excessive crossing of the site.

## B: Monitoring, survey & research

**Objective 3:**
**To establish a monitoring programme to allow review of management prescriptions and assess ecological connectivity with the wider Slamannan Plateau**

**Rationale:**
A comprehensive set of monitoring procedures is required to assess the effectiveness of any habitat management work in furthering the main aim and long-term objectives of the project. This includes ensuring that there are no detrimental effects from the habitat management work on the designated features of the Slamannan Plateau SSSI and SPA. The results of the monitoring will be used to guide the habitat management work.

**Prescriptions:**

### 3.1 Taiga bean goose monitoring

Annual monitoring of the bean geese wintering population on the Slamannan Plateau is carried out by the Bean Geese Monitoring Group on behalf of Scottish Natural Heritage. Bean goose data has been collected for a number of years prior to the commencement of the bog restoration project. Returning Taiga bean geese were recorded on the Slamannan Plateau on the 29th of September 2015. Four geese (possibly 2 pairs) were fitted with GPS transmitter tags by BTO staff on the 9th of October 2015 to help monitor their movements. Location data is collected at intervals during the day and night and is available for use by researchers within 24 hours. It has been encouraging to see that the geese are continuing to roost each night at the roost pools within compartment 11, with all 4 of the tagged geese returning here each night after feeding/loafing in surrounding agricultural fields. It therefore appears that the first phase of restoration work on the site has had no negative impact on the geese using the site. Due to low precipitation levels on the Slamannan Plateau during August, September and October, the newly created 25m x 25m bog pools in compartment 10 have only recently started to fill with water. It remains to be seen if any of the tagged geese will make use of the pools as roosting habitat when they are holding water, Interestingly, as of 11/11/2015 three of the four tagged geese have been tracked entering Compartment 10 near areas with recent surface flooding following dam installation.

### 3.2 Hydrological monitoring

The main aim of the habitat management activities is to restore bog activity at Fannyside Muir by raising the water levels within the peat so that bog vegetation can recolonise. Monitoring how water table levels fluctuate in the bog during the year is essential to ascertain whether the ditch blocking and scrub removal are having the requisite effect. Hydrological monitoring equipment was marked with a white-painted stake and fluttering tape prior to the arrival of excavators on the site to minimise the risk of accidental damage.

#### 3.2.1 Water loggers

Three hydrological data loggers were installed on the site in September 2014 on behalf of SNH (See Figure 8). Water level data is collected every 30 minutes and data is sent automatically once per week. This data will be available on the SEWeb.
The OS grid references for each logger are:

Logger 1: NS 7992 7447
Logger 2: NS 7980 7422
Logger 3: NS 8027 7423

### 3.2.2 Dip wells

A network of 32 ground water dip wells were installed across the restoration site in July 2015 to enable ground water levels to be monitored (Figure 8). Each compartment generally has at least 2 dipwells, with one within 0.5m of a major ditch and another approximately 25m from the first. Dipwells consist of a 1.5m long pipe of 50mm diameter with drilled holes and cap. Readings are taken on a monthly basis using an electronic dipwell meter to collect as much data as possible during the course of the site restoration.

### 3.2.3 Checking integrity of installed dams

The integrity of peat dams and plastic piling dams will be checked regularly after installation, and any issues with leakage or damage identified. The effectiveness of dams in raising ditch water levels will be assessed. The installing contractor has guaranteed the quality of their dams for at least the first 6 months following installation. An annual survey of dam integrity should be carried out on a randomly selected set of dams. Water level below ground level at the face of the dam will be recorded and dams also inspected for damage.

## 3.3 Peat surveys

### 3.3.1 Peat depth survey

Peat depth surveys to help estimate the volume of peat within the project area will be carried out during 2016, this data will also allow a better estimate of the carbon resource contained within peat. This will complement peat depth data collected during bog restoration feasibility study carried out by Strath Caulaidh Ltd in 2014 and an earlier study carried out in 2009 on behalf of Scotts Company Ltd. (RPS, 2011). A report including a peat depth survey will be provided to SNH by the end of year 3 of the project.

### 3.3.2 Peat stability monitoring survey

Due to the generally flat and confined nature of the restoration area, peat slides and bog burst events are considered to be a low risk within the restoration area. Peat instability events may be triggered following intense rainfall and snow melt or loading of the peat mass by heavy machinery.

While the restoration work was on-going and machinery was on the bog, a monthly walk-over of each worked on compartment and neighbouring compartments was carried out to check for the following indicators of peat instability: the presence of recent failure scars, indicators of surface tension, features indicative of compression, evidence of peat creep, the formation of new sub-surface drainage bodies and cracking related to drying. No new peat instability features were observed

## 3.4 Fixed-point photography to monitor condition of the bog

Fixed-point photographs have been taken next to each of the vegetation monitoring quadrats across the restoration site and along a selection of primary ditches to compile a visual record of the changes occurring during the restoration process. In September 2015 RSPB staff and volunteers kindly assisted in capturing aerial images of the site using a digital camera attached to a kite. Despite adverse weather conditions, a number of very useful photographs were obtained showing the extent of the goose roost pools this year just prior to the return of the bean geese. Some of the recently installed restoration features such as reinforced plastic piling dams and the new bog pools were also photographed (see Figure 7). It is hoped that we will be able to make further use of this equipment and potentially a drone with a camera to help monitor changes in vegetation structure that can be difficult to see at ground level.

### 3.5 Bog vegetation monitoring

#### 3.5.1 Fixed-point vegetation quadrat transects

Seven 2m x 2m vegetation monitoring quadrats were installed across the restoration site in spring 2015. These will be monitored on an annual basis (twice yearly if possible) to assess whether habitat management is improving the distribution and abundance of bog vegetation.

Quadrats were marked out using bamboo canes and GPS data collected for each location. Additional information on peatland features such as ditches; grazing and wildlife were also recorded for each quadrat. (See Table 2 for Vegetation Quadrat locations)

Positive (and negative) bog indicator species are clearly defined through JNCC guidance, so it is possible to assess increases or decreases in the distribution and abundance or dominance of positive indicators and negative indicator species. (See Figure 8). Timing of the monitoring should be June- September each year. Prior to the start of restoration work the majority of quadrats were assessed to be in fairly poor condition with restricted Sphagnum moss coverage and few bog specialist species present.

During hydrological monitoring of dipwells, 32 mini vegetation quadrats (0.5m x 0.5m) were recorded at the position of each of the dipwells to enable vegetation change to be compared to any hydrological changes. Data collected included species and % coverage.

| Vegetation Monitoring Quadrat locations | | | |
|---|---|---|---|
| **Quadrat** | **Compartment** | **Grid Reference** | **Current condition** |
| 1 | 2 | NS 79652 73893 | Poor |
| 2 | 3 | NS 79838 73943 | Good (Control) |
| 3 | 3 (border with 4) | NS 79210 74391 | Poor |
| 4 | 5 | NS 79841 74507 | Medium/ Poor |
| 5 | 6 | NS 80543 74436 | Poor |
| 6 | 9 | NS 80379 74362 | Poor |
| 7 | 10 | NS 80184 73952 | Poor |

Table 2. Locations of vegetation monitoring quadrats

Casual recording of vegetation on site during the year identified an area of Japanese knot weed in the car park entrance area (NS 8025 7378). The patch was stem injected with herbicide by FC staff and fenced off prior to contractors arriving on the site. Any regrowth will be monitored and treated.

#### 3.5.2 Annual survey of broadleaf scrub

An annual survey of broad leaved scrub will be made, with the location of new saplings identified by GPS so that they can be removed by contractors or volunteer work parties. This is on-going.

#### 3.5.3 Species-specific butterfly transects

Butterfly transects and timed counts can be used to monitor the impact of habitat management on biodiversity. Butterflies have a 1 year life-cycle and respond rapidly to changes in habitat quality and quantity. UK butterflies include habitat generalists and specialist. Monitoring the presence and abundance of species recorded on a fixed transect transect or during a timed count in a specific area can provide a large amount of data. Butterfly transects are generally carried out once per week for 26 weeks of the year, and only under specific environmental conditions which allows data to be compared with other

sites and between years. Species-specific transects and timed counts can be used to monitor particular species. These restricted surveys are carried out only during the flight period of the species that is of interest. Distribution data can be used to assess the ecological connectivity of the site, and abundance data can be used to assess habitat management changes. A butterfly identification and transect training workshop was held in May 2015 at Palacerigg Country Park to attract volunteers to help with the monitoring of the site.

### 3.5.4 Butterfly transect - Large heath (*Coenonympha tullia*)

The Large heath (*Coenonympha tullia*) is a UK BAP species and a bog specialist, with its larvae feeding on Common cottongrass (*Eriophorum angustifolium*) and Hare's tail cottongrass (*E. vaginatum*), that are fairly widespread across Fannyside Muir. The species has declined across Europe. The adult flight period in central Scotland is generally from mid June through to the end of July, with individuals occasionally still flying in early August. Adults are attracted to the flowers of Cross-leaved heath (*Erica tetralix*). Weekly timed-counts for this species were carried out from June through to early August, but no confirmed observations were made.

### 3.5.5 Butterfly transect - Small pearl-bordered fritillary (*Boloria selene*)

The Small pearl-bordered fritillary (*Boloria selene*) is a UK BAP species and in central Scotland is associated with damp meadows, bogs and other wetland habitats. The larvae generally feed on the leaves of Marsh violet (*Viola palustris*), but other *Viola sp.* may be used. Marsh violets were observed to be present in small quantities along the verges of Fannyside Road and within the fen vegetation present between compartments 1 and 2 of the project area. The species has been lost from many parts of the UK, but remains widespread in Scotland. The adult flight period in central Scotland is generally from mid-June through to the end of July, with individuals occasionally still flying in early August. Timed counts for this species were carried out from early-June through to early August. Individuals were recorded during July at various locations close to where marsh violets had been observed, including close to the road verge of compartment 3 and in the species-rich 'fen' area between compartments 1 and 2.

## 3.6 Bog-specialist invertebrate surveys

Invertebrates make up the majority of the UK's biodiversity. Analysis of the rich diversity of invertebrate species found within a site can provide useful information regarding the types and quality of the habitat present. Generalist species can be found in many different habitats and in some cases may be negative-indicators of habitat quality. On the other hand, bog specialists may be restricted to high-quality bog habitat containing the specific resources required to complete that species' lifecycle. Surveys carried out from winter 2014 through to autumn 2015 included pitfall trapping within each of the fixed-point 2m x 2m vegetation quadrats, moth trapping using light traps, sweeping vegetation for invertebrates, pond netting for aquatic invertebrates and direct observations.

### 3.6.1 Sun bog-jumper spider (*Heliophanus dampfi*)

The Sun bog-jumper spider (*Heliophanus dampfi*) is a small black jumping spider (family Salticidae), associated with raised bogs. The species is known from only a handful of sites in the central belt of Scotland and a single site in Wales. No observations of this species were made during 2015, but targeted surveys are planned for 2016 using a BugVac/ modified leaf blower to sample invertebrates in mosses and tussocks across the site.

### 3.6.2 Light trapping for moths

The UK has over 2,500 species of moths, comprising a wide range of families, with habitat generalists and specialists, mobile and sedentary species, and includes a number of species associated with peatlands and bogs. Research on habitat restoration has shown that light-trapping for moths can be an effective way of monitoring changes in vegetation structure and connectivity to other habitats. The loss of species feeding on broad leaf scrub and non-bog vegetation, and an increase in wetland specialist might be expected.

Two types of light traps have been ran at Fannyside Muir during 2015: a 15 W actinic heath trap, and an 80W mercury vapour Robinson trap. (See Figure 8). In addition to species recorded using light trapping, observations of day-flying species, caterpillars and distinctive leaf-mines were used to add additional species to the site species list.

### 3.6.3 Other species surveyed

At the start of the project, very few species had been recorded from the restoration site. An assessment of aquatic species using the site would provide a good baseline for further assessment of habitat work. Increasing the presence of standing water on the site through blocking ditches is expected to have a positive effect on the presence and abundance of dragonflies and damselflies, water beetles, stoneflies, mayflies, alderflies, caddisflies and other species.

Pitfall transects across the bog may provide useful data on beetle and spider composition across the restoration site. Both of these orders contain a range of families and genera with habitat specialists that will be informative of habitat changes occurring during the restoration process.

## C: Visitor engagement and promotion

**Objective 4:**
**To raise public awareness of issues affecting peatlands**

**Rationale:**
This project has the opportunity to raise public awareness of the issues affecting lowland raised bogs in the Central belt and peatlands in Scotland. Engaging with local communities, community groups and schools around Fannyside Muir will be a key part of outreach associated with the project. Through the project at least 50 young people will be engaged each year through educational events. As well as ecological and environmental benefits, the project will provide the local community with opportunities for volunteering and outdoor education. Opportunities may be provided for members of the public to visit the restoration site, hear about the project at community events and talks, and to take part in habitat management volunteer work. Volunteer training workshops will also be provided to help with monitoring activities. All outreach and communication actions will be coordinated with other local groups already raising awareness of the importance of peatland including North Lanarkshire Council, Forestry Commission, Cumbernauld Living Landscape, SWT, RSPB and the Bean Goose Action Group.

**Prescriptions:**
**4.1 Press releases and media**
A number of press releases, articles for newsletters and magazines, and social media posts were produced throughout the year to promote the work at Fannyside Muir and raise awareness of our peatlands.

### 4.2 Educational visits

A programme of educational activities for local schools has been created to raise awareness of the importance of Fannyside Muir and our wider peatlands. Schools in Cumbernauld, Slamannan and other communities around Fannyside Muir will learn about peat bogs, and focus on 2 key species: the Large heath butterfly and the Taiga bean goose. School visits will be carried out during the winter of 2015/2016 and site visits to Fannyside Muir are planned for the spring and autumn of 2016.

### 4.3 Community engagement activities

Local community engagement activities this year have been restricted to delivering monitoring workshops and training, and volunteer work parties; however a number of local school visits are planned for the winter and spring of 2015/16.

#### 4.3.1 Walks and talks.

Site visits with different groups were held at Fannyside Muir during the winter of 2014 and summer and autumn of 2015. Groups including staff, members and volunteers of various conservation NGOs (Buglife, Butterfly Conservation, RSPB, East Ayrshire Coalfield Initiative), SNH staff and Scottish Local Biodiversity Officers were shown round the restoration site. Talks to raise awareness of peatlands and the restoration project at Fannyside Muir have been given to organisations including the Hamilton Natural History Society and the 2015 Scottish meeting of the British Arachnological Society.

#### 4.3.2 Volunteer recruitment and training workshops.

Two habitat management volunteer work parties were held this year. On Saturday 12th September, 4 volunteers helped clear gorse and birch scrub from part of the railway bund. This event coincided with National Moth Night and moth traps were run at Fannyside Muir on the Friday and Saturday night. The second volunteer work party was a joint event with Butterfly Conservation's Bog Squad on Saturday 31st October. This event attracted 8 volunteers to help clear gorse and birch scrub and extend the width of plastic piling dams to help retain more water in blocked ditches. A third work party in 2015 is planned for Sunday 6th December, which will focus on extending plastic piling dams and removal of regenerating conifers (mostly lodgepole pine and spruce). Five people attended a free butterfly identification and monitoring workshop was held at Palacerigg Country Park to attract volunteers to help with butterfly monitoring at Fannyside Muir. Two volunteers attended a site visit on Saturday 20th June to identify suitable areas to focus Large heath and Small pearl-bordered fritillary surveys.

## Administration

**Objective 5:**

**To fulfil all legal or contractual obligations committed to within the plan period**

**Rationale:**

All legal and contractual obligations committed to within the plan period must be carried out.

**Prescriptions:**

### 5.1 Hold regular Stakeholder/ Steering Group meetings

The current Steering Group for the project comprises individuals from the Bean Goose Action Group, Buglife, Cumbernauld Living Landscape, Forestry Commission Scotland, North Lanarkshire Council, RSPB, Scottish Natural Heritage and the Scottish Wildlife Trust. A stakeholder meeting was held at Palacerigg Country Park on the 28th October 2015.

### 5.2 Annual review of project implementation
A review of progress on the implementation of objectives and prescriptions to deliver the management plan will take place annually. This will ensure that management techniques are delivering the anticipated results. An annual review of implementation will allow budgeting of staff time, funding and development of more detailed work plans for the coming year.

### 5.3 Revise management plan
Progress on the delivery of the management plan will be assessed annually, with a full review after 5/10 years.

### 5.4 Comply with all relevant legislation
Ensure that all SNH, SEPA, FC, NLC and SWT permissions and other consents are adhered to during the project. A Habitat Regulations Assessment of the planned work at Fannyside Muir was carried out by SNH to minimise the risk of any of the interventions having a negative impact on the designated features of the Slamannan Plateau SSSI and SPA. A report to inform this assessment was kindly produced by Toby Wilson of RSPB Scotland.

### 5.5 Maintain site species lists (all taxa)
A total of 478 species have been recorded at Fannyside Muir since the launch of the project in September 2014. Records of all species observed and monitored during the project will be maintained in a database. Records include details of scientific name (with common name if there is one), location, OS grid reference (at least 6 figure), date (first record if common and frequently recorded), abundance, recorder, determiner, survey method and any additional comments.

**Summary of species recorded in Year 1:**
(A full list of species recorded at Fannyside Muir is given in the appendix)

**Flora and Fungi**
A total of **109** vascular plants and **18** lower plants and fungi have been recorded at Fannyside Muir this year, including **15** mosses and **3** lichens and **2** fungi.

**Notable bog-associated plant and bryophytes recorded at Fannyside include:**
Blaeberry (*Vaccinium myrtillus*)
Bog asphodel (*Narthecium ossifragum*)
Common cottongrass (*Eriophorum angustifolium*)
Cranberry (*Vaccinium oxycoccus)*
Cross-leaved heath (*Erica tetralix)*Deer grass (*Trichophorum cespitosum*)
Hare's-tail cottongrass *(Eriophorum vaginatum*)
Heather (*Calluna vulgaris)*
Round-leaved sundew (*Drosera rotundifolia*)
White-beaked sedge (*Rhynchospora alba*)
Acute-leaved bog-moss (*Sphagnum capillifolium*)
Blunt-leaved bog-moss (*Sphagnum palustre*)
Bogmoss flapwort (*Odontoshisma sphagnii*)
Feathery bog-moss (Sphagnum *cuspidatum*)
Flat-topped bog-moss (*Sphagnum fallax*)
Magellanic bog-moss (*Sphagnum magellanicum*)
Papilose bog-moss (*Sphagnum papillosum*)
Soft bog-moss (*Sphagnum tenellum*)

**Birds:**

A Total of **59** species of birds have been recorded at Fannyside Muir. Breeding bird surveys carried out between April and June 2015 by Caledonian Conservation Ltd found **7** species breeding on site including **5** Amber-listed or Red-listed species in the Birds of Conservation Concern List (BoCC) (Eaton *et al*. 2009)

**Notable bird species recorded at Fannyside in include:**

**Breeding species recorded in 2015**

Redshank (*Tringa tetanus*). (Amber listed). 2 breeding territories recorded,
Meadow pipit (*Anthus pratensis*) (Amber listed).120+ breeding pairs recorded.
Skylark (*Alauda arvensis*). (Red listed). 10 breeding territories recorded.
Curlew (*Numenius arquata*). (Amber listed). 1 breeding territory recorded.
Willow warbler (*Phylloscopus trochilus*). (Amber listed). 2 breeding territories recorded.

**Non-breeding notable species**

Taiga bean goose (*Anser fabalis fabalis*) (Amber listed). Winter resident and designated natural feature of the Slamannan Plateau SSSI and SPA. Taiga bean geese first began overwintering on the Slamannan Plateau in 1981. Numbers vary from year to year, with around 130- 150 birds in the 1990's which has increased in recent years to around 250-300 birds. The geese tend to feed on agricultural fields around the plateau and return at dusk to roost on the Fannyside Lochs or in the bog pool matrix present in the south-east of the core restoration site (Compartment 11). The first geese to return in 2015 arrived on the Slamannan Plateau on the 29th September.
Grasshopper warbler (*Locustella naevia*). (Red listed)
Hen harrier (*Circus cyaneus*). (Red Listed)* Recorded at Garbethill.
Herring gull (*Larus argentatus*). (Red listed)
Lapwing (*Vanellus vanellus*). (Red listed)
Lesser redpoll (*Acanthis cabaret*). (Red listed)
Starling (*Sturnus vulgaris*). (Red listed)
Dunlin (*Calidris alpina*) (Red listed)
Other species (including Amber-listed species) are listed in the appendices.

**Mammals:**

A total of **5** species of mammal have been recorded at Fannyside Muir this year. Roe deer have been seen and tracks and scat/droppings of foxes and voles have been recorded during site visits.

**Notable mammal species recorded at Fannyside include:**

Bank vole (*Myodes glareolus*) – remains and droppings
Brown hare (*Lepus europeaus*)
Otter (*Lutra lutra*) – scat & foot prints
Red fox (*Vulpes vulpes*) –scat & footprints
Roe deer (*Capreolus capreolus*)

**Reptiles and Amphibians:**

A total of **2** amphibian species and **1** reptile species have been recorded at Fannyside Muir this year.

**Notable reptiles and amphibian species recorded at Fannyside include:**

Common lizard (*Zootoca vivipara*)
Common frog (*Rana temporaria*)

Common toad (*Bufo bufo*)

**Invertebrates:**
A total of **284** invertebrate species have been recorded from Fannyside Muir this year, including **83** species of moths & butterflies, **58** flies, **45** beetles, **26** true bugs, **21** spiders, **19** bees and wasps, **7** dragonflies & damselflies, **3** slugs, **3** ants, **2** harvestmen, **2** stoneflies, **2** springtails, **2** lacewings, **2** woodlice, **2** mayflies, **1** centipede, **1** grasshopper, **1** scorpionfly, **1** sawfly, **1** alderfly, **1** millipede and **1** earwig.

**Notable Invertebrate species recorded at Fannyside include:**
Small heath (*Coenonympha pamphilus*) UKBAP
Small pearl-bordered fritillary (*Boloria selene*) UKBAP
Garden Tiger (*Arctia caja*) UKBAP
Heath Rustic (*Xestia agathina*) UKBAP
Latticed Heath (*Chiasmia clathrata*) UKBAP
Sallow (*Xanthia icteritia*) UKBAP
diving beetle (*Stictonectes lepidus*) IUCN Near threatened
ground beetle (*Agonum ericeti*) Nationally Scarce * bog indicator species

**5.6 Produce connectivity maps for key bog species**
Species distribution data collected during the project will be used to produce connectivity maps to identify ecological coherence in the project area. Monitoring data will also be used to assess changes in habitat quality with regards to key bog-species colonisation and/or resource usage. This is on-going.

**5.7 Ensure all species records regularly added to NBN**
Records collected from the site (excluding sensitive data) will be added to the National Biodiversity Database (NBN) at capture resolution on an annual basis to improve public knowledge of species distribution. Potentially sensitive data will be added at lower resolution, or omitted from datasets depending on discussions with stakeholders. All species data will be shared with stakeholders and landowners in formats suitable for incorporation into existing stakeholders datasets.

## 4. Plans for 2016

During 2016, restoration work will focus on Compartments 1 (North Lanarkshire Council-owned), 4 (SWT- owned), and 6 (Forestry Commission-owned) (see map 2), where ditch-blocking (peat dams and piling dams), scrub removal, and potentially cell-bunding techniques, will be used to stabilise water levels and improve bog habitat.
.
Hydrological and vegetation monitoring will continue throughout the site. There will be further surveys for key bog-specialist invertebrates such as the Bog sun-jumper spider and Large heath butterfly. Peat depth surveys to help estimate the carbon resource held within the peat will be carried out across the core project area in 2016.

In addition to the existing 'core' project area shown in Map 2, a number of neighbouring areas of degraded bog habitat have been identified by the Forestry Commission and North Lanarkshire Council (see map 4).

Restoration work to improve bog habitat within these newly-identified areas and enhance their coherence with the core project site will bring many benefits.

Incorporating the management of these new areas into the existing Management Plan will help improve watershed management across the entire site, allow the reconnection of fragmented areas of existing bog habitat and the movement of bog-specialist species. It will also greatly increase the area of bog habitat within the Slamannan Plateau under conservation management. Total new area under management would be approximately 310 hectares.

Areas marked A, B, C and D in map 4, have been identified as priority areas for restoration in 2016, where targeted intervention will see improvements not only for those areas, but the wider project area too. Felling and restoration of areas E, F and G would also bring significant benefits including improved ecological connectivity with Garbethill Muir.

**Acknowledgements**

Buglife Scotland would like to thank everyone who has contributed their support and advice during the first year of the Fannyside Muir Bog Restoration Project including staff from Forestry Commission Scotland, Scottish Wildlife Trust, North Lanarkshire Council, RSPB, Cumbernauld Living Landscape, East Ayrshire Coalfield Initiative and SNH.

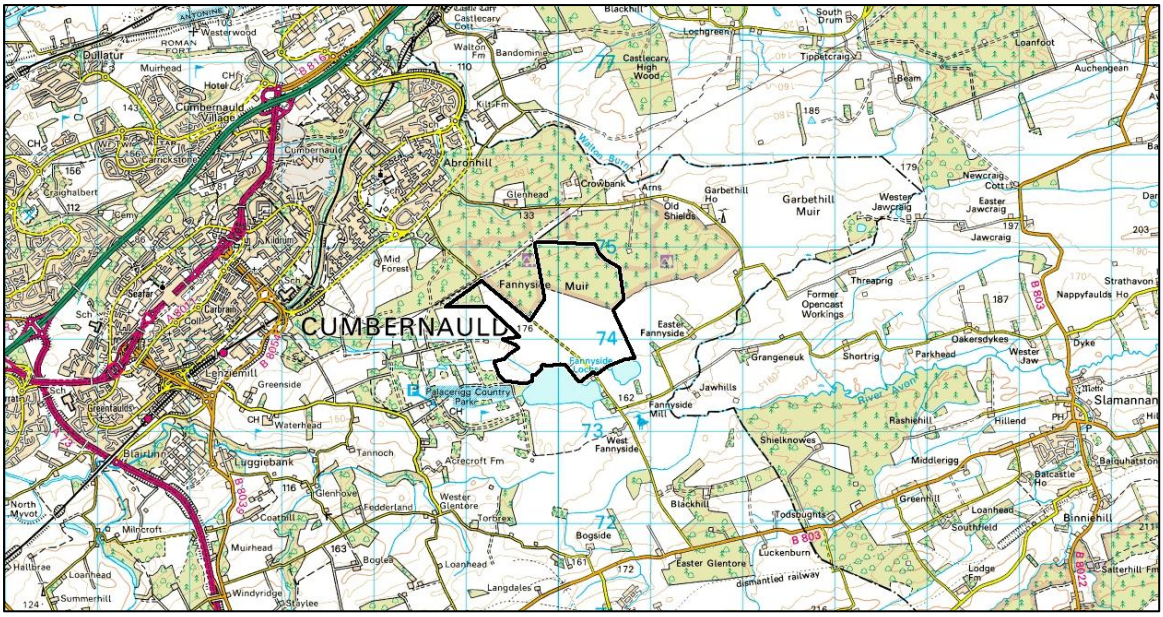
Special thanks are due to Emma Stewart (FCS), Yvonne Grieve (FCS) and Toby Wilson (RSPB Scotland) for contributing many hours of their time to help with the project over the last year. Thank you!

**Projects Planned to Occur During the Life of the Plan**
The numbers refer to priority, 1 being essential and 2 highly desirable. Yellow: achieved. Orange: partially achieved. Red- not achieved.

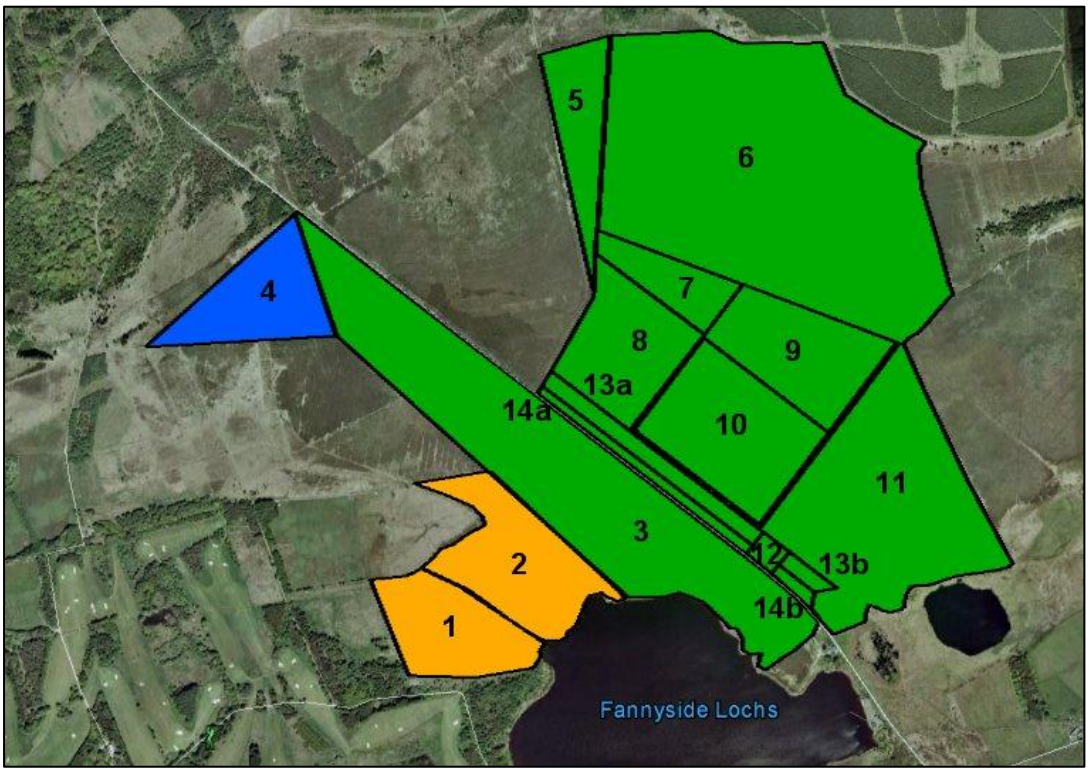
| Code | Project | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.1 | Use of low ground-pressure machine to cross-track bog surface * | **1** | 2 | | | | | | | | |
| 1.2.1 | Dam Installation (plastic piling) | **1** | 1 | 2 | | | 2 | | | | |
| 1.2.2 | Dam Installation (peat dams) | **1** | 1 | 2 | 2 | | 2 | | | | |
| 1.2.3 | Reprofile sides of steep primary ditches | **2** | 2 | 2 | 2 | 2 | | | | | |
| 1.2.4 | Reducing water evaporation from ditches with heather bundles | **2** | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 1.3.1 | Felling and treatment of broadleaf scrub | **1** | 1 | | 2 | | 1 | | 2 | | 1 |
| 1.3.2 | Hand pulling of small broadleaf scrub with volunteers | **1** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1.3.3 | Conservation grazing | | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2.1 | Enhancing habitat for roosting geese at Fannyside Muir | **1** | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 2.2 | No restoration work to occur while geese present on the site. | **1** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2.3 | Restoration work to avoid areas containing winter roost pools used by Taiga bean geese. | **1** | 1 | 1 | 1 | 1 | | | | | |
| 2.4 | Sensitive use of heavy machinery on site | **1** | 1 | 1 | 1 | 1 | | | | | |
| 3.1 | Taiga bean goose monitoring | **1** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3.2 | Hydrological monitoring – water loggers and dip wells | **1** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3.3.1 | Peat depth survey | **2** | 2 | 1 | | | | | | | |
| 3.3.2 | Peat stability monitoring | **1** | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3.4 | Fixed-point photography to monitor condition of bog | **1** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.4.1 | Bog vegetation monitoring – Fixed-point quadrat transects | **1** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3.4.2 | Annual survey of broad leaf scrub | **1** | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3.5.1 | Butterfly transect- Large Heath | **1** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3.5.2 | Butterfly transect- Small pearl-bordered fritillary | **1** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3.6.1 | Bog-specialist invertebrate surveys – Bog sun-jumper spider | **1** | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3.6.2 | Bog-specialist invertebrate surveys – light trapping | **1** | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3.6.3 | Bog-specialist invertebrate surveys – Odonata surveys | **1** | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3.6.4 | Bog-specialist invertebrate surveys – aquatic invertebrate survey | **1** | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3.6.5 | Bog-specialist invertebrate surveys – other species | **1** | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 4.1 | Press releases and media | **1** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 4.1 | Educational activities (50 young people engaged per year) | **1** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 4.2 | Local community engagement activities- talks & guided walks | **1** | 1 | 1 | 1 | | | | | | |
| 4.3 | Local community engagement activities- volunteer training | **1** | 1 | 1 | 1 | | | | | | |
| 5.1 | Hold regular Steering Group and stakeholder meetings | **1** | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| 5.2 | Annual review of project implementation | **1** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 5.3 | Revise the management plan | | | | | 1 | | | | | 1 |
| 5.4 | Comply with all relevant legislation | **1** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 5.5 | Maintain site species lists (all taxa) | **1** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 5.6 | Produce connectivity maps for key bog species | **1** | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 5.7 | Ensure all species records regularly added to NBN | **2** | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

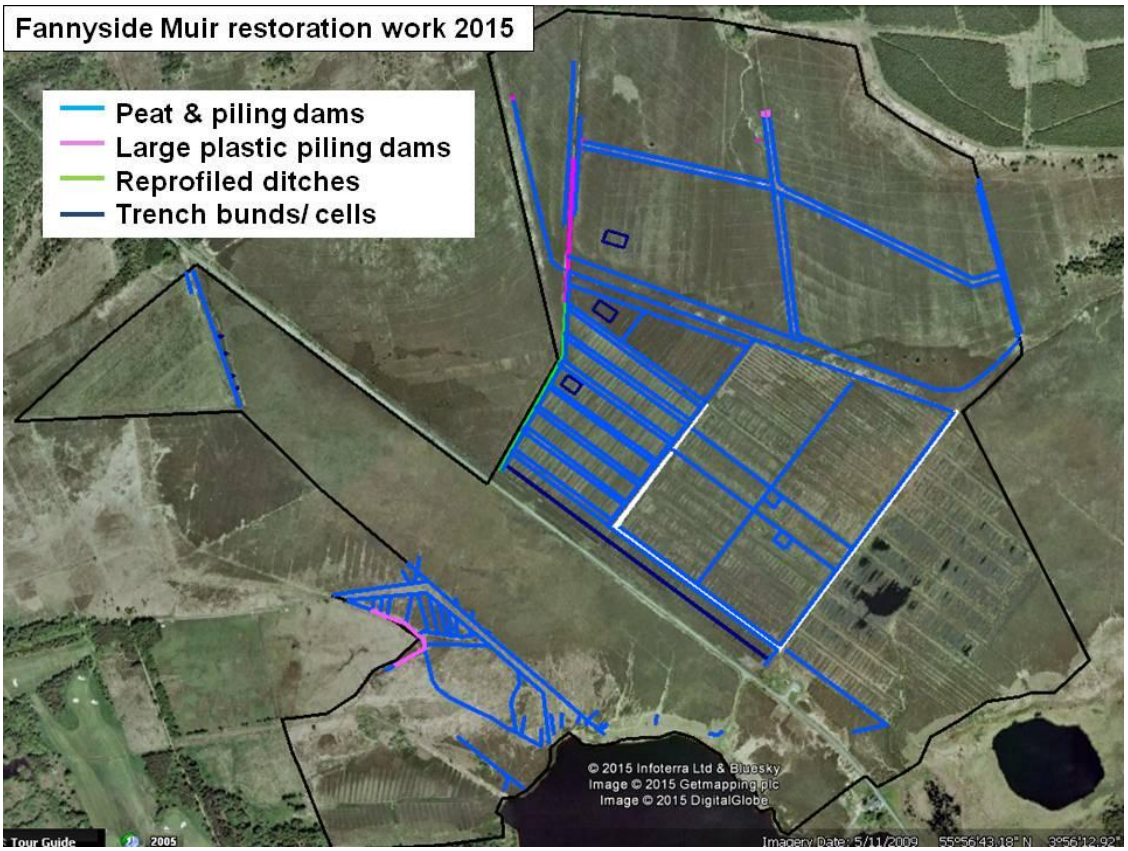
## Appendix i. Maps



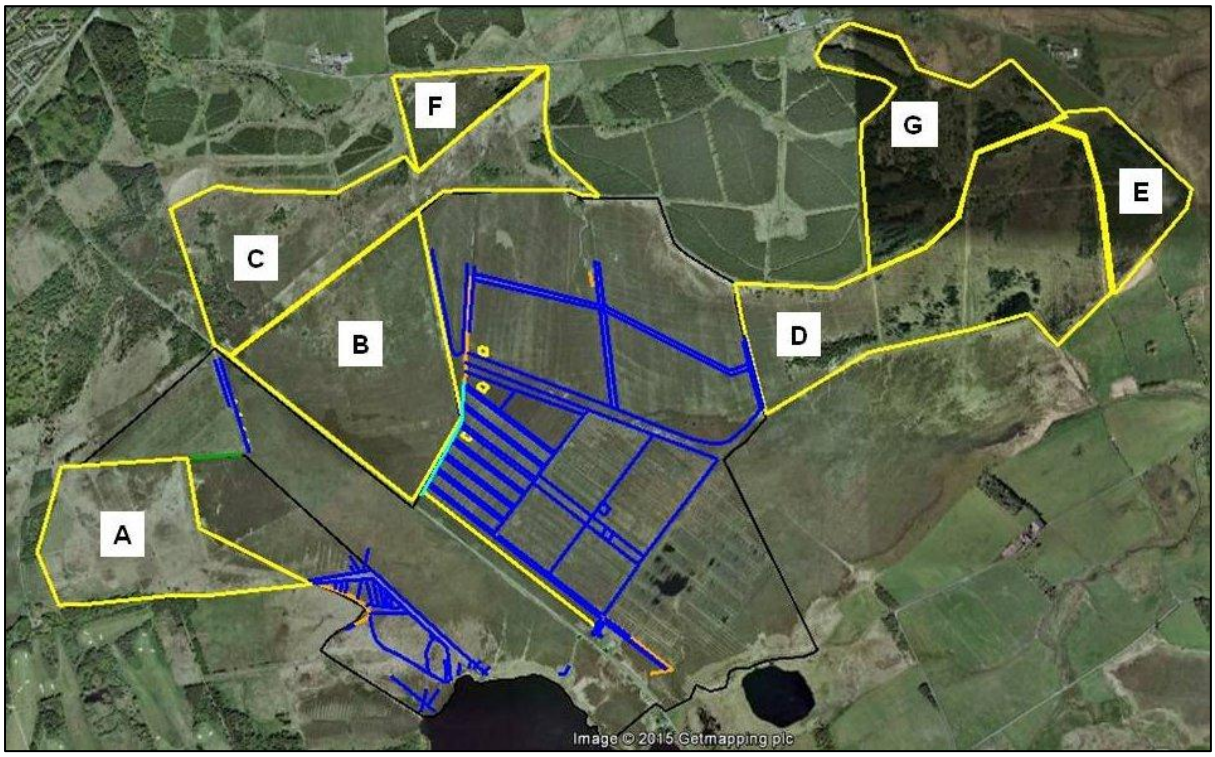

**Map 1: Location of Fannyside Muir bog restoration site**
Core project area outlined in black. 3km east of Cumbernauld on the Slamannan Plateau.




**Map 2: Compartments and land ownership within restoration area.**
North Lanarkshire Council (NLC) in orange; Forestry Commission Scotland (FCS) in green and Scottish Wildlife Trust (SWT) in blue. Numbers relate to Compartments mentioned in the Management Plan.




**Map 3. Overview of restoration work carried out at Fannyside Muir during 2015.**




**Map 4. Newly identified areas adjacent to the core project area.**
A: North Lanarkshire Council-owned land. B-G: Forestry Commission-owned land. All of these areas are outwith the boundaries of the Slamannan Plateau SSSI and SPA.

## Appendix ii. Photographs

**Figure 1. Installation of trench bund in Compartment 13a.**
Top Left: Excavator installing trench bund (2 m deep). Top Right: Compressed surface of peat bund prior to capping with a dome of peat and vegetation. Bottom: 0.5m high cap of peat and vegetation along top of trench bund.

**Figure 2. Peat dams on ditch between Compartments 7 and 8.**
Left: Just after installation. Right: Late September- blocked ditches filling with water.

**Figure 3. Installation of 4m deep plastic piling dams on large ditch between Compartments 5 and 6 at Fannyside Muir.**
Clockwise from Top Left: First 4m piling dams being installed on deep boundary ditch.; Large eroded ditch prior to installation of piling dams.; Manual adjustment needed during installation of piling dams.(this one with peat back-filled for extra support); Supported piling dam before bracing timbers installed.; Same ditch very full of water in late October 2015.

**Figure 4. Large ditch in Compartment 2 at Fannyside Muir before and after installation of reinforced plastic piling dams**.
Left: Before work began. Right:  Same ditch in late October 2015 after 3 days of rain.

**Figure 5. Reprofiling steep-sided boundary ditch.**
Left: Before work began (Facing north-east). Right: Reprofiling and peat dam installation along ditch with excavator (Facing south).

**Figure 6. Installation of new 25m x 25m pool in Compartment 10 at Fannyside Muir as potential roosting habitat for Taiga bean geese.**

**Figure 7. Aerial photograph showing extent of 'roost pools' in Compartment 11**
Taken using a 'kite camera' in September 2015 with assistance of RSPB Glasgow & South West Scotland staff and volunteers.

**Figure 8. Monitoring at Fannyside**.

Top Left: Water logger. Top Middle: Dipwell and mini-vegetation quadrat. Top Right. Species from control vegetation quadrat (Sphagnum sp., Cranberry, Cross-leaved heath, Round-leaved sundews). Centre Right: Reptile monitoring tile. Centre Left: Light trap (in gully between Compartments 1 and 2). Bottom Left: Five Common lizards (on abandoned duvet) in car park/ entrance area. Bottom Right: Sampling bog pool for aquatic invertebrates.

## Appendix iii. Site Species Lists

Lists of species recorded within the Fannyside Muir bog restoration area.
* Species recorded nearby (ie. Fannyside RSPB reserve or Palacerigg Country Park etc.).

### 3.1 Flora and fungi

#### 3.1.1 Higher Plants

# Species only recorded from car park/ site compound or road verges

**Key bog indicator species**

Blaeberry (*Vaccinium myrtillus*)
Bog asphodel (*Narthecium ossifragum*)
Common cottongrass (*Eriophorum angustifolium*)
Cranberry (*Vaccinium oxycoccus)*
Cross-leaved heath (*Erica tetralix)*
Deer grass (*Trichophorum cespitosum*)
Hare's-tail cottongrass *(Eriophorum vaginatum*)
Heather (*Calluna vulgaris)*
Round-leaved sundew (*Drosera rotundifolia*)
White-beaked sedge (*Rhynchospora alba*)

**Other species (including negative bog quality indicator species)**

Alder (*Alnus glutinosa*) #
Ash (*Fraxinus excelsior*) #
Angelica (*Angelica sylvestris*)
Annual meadow-grass (*Poa annua*)
birch (*Betula sp.*)
Bird's foot trefoil (*Lotus corniculatus*)
Biting stonecrop (*Sedum acre*) #
Bog pond weed (*Potamageton polyponifolius*)
Bracken (*Pteridium aquilinum*)
bramble (*Rubus fruticosus*) #
bridewort (*Spirea* sp.) #
Broad-leaved dock (*Rumex obtusifolius*) #
Broad leaved willowherb (*Epilobium montanum*) #
Broom (*Cytisus scoparius*) #
Bush vetch (*Vicia sepium*)#
Carnation sedge (*Carex panicea*)
Cock's foot grass (*Dactylis glomerus*) #
Colts foot (*Tussilago farfara*)
Common bent (*Agrostis capillaris*)
Common couch grass (*Elytrigia repens*) #
Common knapweed (*Centaurea nigra*)
Common rhododendron (*Rhododendron ponticum*)
Common silverweed (*Argentina anserine*) #
Common sorrel (*Rumex acetosa*) #
Common orache (*Atriplex patula*) #
Common spotted orchid (*Dactylorhiza fuchsia*)
Common twayblade (*Listera ovata*)
Common valerian (*Valeriana officinalis*) #
Cow parsley (*Anthriscus sylvestris*) #
Creeping buttercup (*Ranunculus repens*)
Creeping forget-me-not (*Myositis secunda*) #

Creeping thistle (*Cirsium vulgare*) #
Cuckoo flower (*Cardamine pratensis*) #
Daisy (*Bellis perennis*) #
Dame's violet (*Hesperis matronalis*) #
dandelion (*Taraxacum* sp.)
Devil's bit scabious (*Succisa pratensis*)
eyebright (*Euphrasia* sp.)
Field horsetail (*Equisetum arvense*) #
Garden strawberry (*Fragaria x ananassa*) #
Goat willow (*Salix caprea*)
Gorse *(Ulex europeaus*)
Great willowherb (*Epilobium hirsutum*)
Ground elder (*Aegopodium podagraria*) #
Hairy wood-rush (*Luzula pilosa*)
Hard fern (*Blechnum spicant*)
Hawkweeds (*Hieracium* sp.) #
Hawthorn (*Crataegus monogyna*)
Heath bedstraw (*Galium saxatile*)
Heath milkwort (*Polygala serpyllifolia*)
Heath spotted orchid (*Dactylorhiza maculata*)
Hop trefoil (*Trifolium campestre*) #
Japanese knotweed (*Fallopia japonica*) #
Japanese rose (*Rosa rugosa*) #
Kidney vetch (*Anthyllis vulneraria*) #
Knotgrass (*Polygonum aviculare*) #
Lodgepole pine (*Pinus contorta*)
Lungwort (*Pulmonaria officinalis*) #
Marsh arrow-grass (*Triglochin palustris*) #
Marsh cinquefoil (*Potentilla palustris*)
Marsh lousewort (*Pedicularis palustris*)
Marsh thistle (*Cirsium palustre*)
Marsh violet (*Viola palustris*)
Meadow vetchling (*Lathyrus pratensis*)
Michaelmas daisy (*Aster x salignus*) #
Montbretia (*Crocosmia x crocosmiiflora*) #
Narrow buckler fern (*Dryopteris carthusiana*)
Nipplewort (*Lapsana communis*) #
Purple moor grass (*Molinia caerulea*)
Ragwort (*Senecio jacobaea*) #
Raspberry (*Rubus idaeus*) #
Red bartsia (*Odontites vernus*) #
Red clover (*Trifolium pratense*) #
Red fescue (*Festuca rubra*) #
Reed mace (*Typha latifolia*)
Ribwort plantain (*Plantago lanceolata*)
Rosebay willowherb (*Epilobium angustifolium*) #
Rowan (*Sorbus aucuparia*)
rushes (*Juncus sp.*)
sallows (*Salix sp.*)
Scots pine (*Pinus sylvestris*)
Selfheal (*Prunella vulgaris*)
Short-fruited willowherb (*Epilobium obscura*) #
Silver birch (*Betula pendulus*)

Sitka spruce (*Picea sitchensis*)
Smooth sow-thistle (*Sonchus oleraceus*) #
Sneezewort (*Achillea ptarmica*)
Soft rush (*Juncus effusus*)
Spear thistle (*Cirsium arvense*) #
Stinging nettle (*Urtica dioica*) #
Sweet vernal grass (*Anthoxanthum odoratum*)
Tormentil (*Potentilla erecta*)
Tufted hair grass (*Deschampsia cespitosa*)
Wavy bittercress (*Cardamine flexuosa*) #
White clover (*Trifolium repens*) #
Yarrow (*Achillea milllefolium*)
Yellow flag iris (*Iris pseudacorus*)
Yellow loosestrife (*Lysimachia vulgaris*) #
Yellow rattle (*Rhinanthus minor*) #

### 3.1.2 Bryophytes, fungi and lichens

**Bryophytes (including key bog indicator species)**
Acute-leaved bog-moss (*Sphagnum capillifolium*)
Blunt-leaved bog-moss (*Sphagnum palustre*)
Bogmoss flapwort (*Odontoshisma sphagnii*)
Common haircap moss *(Polytrichum commune*)
Feathery bog-moss (Sphagnum *cuspidatum*)
Flat-topped bog-moss (*Sphagnum fallax*)
Heath plait moss (*Hypnum jutlandicum*)
Heath star moss (*Campylopus introflexus*)
Magellanic bog-moss (*Sphagnum magellanicum*)
Papilose bog-moss (*Sphagnum papillosum*)
Soft bog-moss (*Sphagnum tenellum*)
Turf moss (*Rhytidiadelphus* sp.)
Waved silk moss (*Plagiothecium undulatum*)

**Lichens**
Devil's matchstick lichen (*Cladonia floerkeana*)
lichen (*Cladonia chlorophaea* agg.)
lichen (*Peltigera membranacea*)

**Fungi**
Yellow brain (*Tremella mesenterica*) – on gorse
Rosy crust (*Peniophora incarnate*) – on gorse

### 3.2 Birds

Barn owl (*Tyto alba*) * Recorded at Palacerigg Country Park
Barn swallow (*Hirundo rustica*)
Blackbird (*Turdus merula*)
Black-headed gull (*Chroicocephalus ridibundus*)
Blue tit (*Cyanistes caeruleus*)
Bullfinch (*Pyrrhula pyrrhula*) * Recorded at RSPB Fannyside
Buzzard (*Buteo buteo*)
Canada goose (*Branta canadensis*)
Carrion crow (*Corvus corone*)
Chaffinch (*Fringilla coelebs*)
Coal tit (*Periparus ater*)

Coot (*Fulica atra*) * Recorded at RSPB Fannyside
Common crossbill (*Loxia curvirostra*) * Recorded at RSPB Fannyside
Common kestrel (*Falco tinnunculus*) * Recorded at SWT Forest Wood
Common sandpiper (*Actitis hypoleucos*)
Cuckoo (*Cuculus canorus*) * Recorded at RSPB Fannyside
Curlew (*Numenius arquata*)
Dunlin (*Calidris alpina*)
Feral pigeon (*Columba livia*)
Fieldfare (*Turdus pilaris*)
Goldcrest (Regulus regulus) * Recorded at RSPB Fannyside
Goldeneye (*Bucephala clangula*) * Recorded at RSPB Fannyside
Goldfinch (*Carduelis carduelis*)
Gooseander (*Mergus merganser*) * Recorded at RSPB Fannyside
Grasshopper warbler (*Locustella naevia*)
Greater spotted woodpecker (*Dendrocopos major*) * Recorded at Palacerigg Country Park
Great black-backed gull (*Larus marinus*)
Great tit (*Parus major*)
Greylag goose (*Anser anser*)
Grey Heron (*Ardea cinerea*)
Grey partridge (*Perdix perdix*) * Recorded at RSPB Fannyside
Hen harrier (*Circus cyaneus*) * Recorded at Garberthill
Herring gull (*Larus argentatus*)
House Martin (*Delichon urbicum*)
Jackdaw (*Corvus monedula*) * Recorded at RSPB Fannyside
Jay (*Garrulus glandarius*)
Jack snipe (*Lymnocryptes minimus*)
Kestrel (*Falco tinnunculus*) * Recorded at RSPB Fannyside
Lapwing (*Vanellus vanellus*)
Lesser black-backed gull (*Larus fuscus*)
Lesser redpoll (*Acanthis cabaret*)
Linnet (*Carduelis cannabina*) * Recorded at RSPB Fannyside
Little grebe (*Tachybaptus ruficollis*) * Recorded at RSPB Fannyside
Long-eared owl (*Asio otus*) * Recorded at RSPB Fannyside
Mallard (*Anas platyrhynchos*)
Magpie (*Pica pica*)
Marsh harrier (*Circus aeruginosus*) * Recorded at RSPB Fannyside
Meadow pipit (*Anthus pratensis*)
Merlin (Falco columbarius) * Recorded at Toddleknowe Muir
Moorhen (*Gallinula chloropus*) * Recorded at RSPB Fannyside
Oystercatcher (*Haematopus ostralegus*)
Raven (*Corvus corax*) –flying overhead
Redshank (*Tringa tetanus*)
Peregrine (*Falco peregrinus*) * Recorded at RSPB Fannyside
Pink-footed goose (*Anser brachyrhynchus*)
Ringed plover (Charadrius hiaticula) * Recorded at RSPB Fannyside
Pheasant (*Phasianus colchicus*)
Pied wagtail (*Motacilla alba*)
Robin (*Erithacus rubecula*)
Red grouse (*Lagopus lagopus* scotica)
Red-necked diver (*Podiceps grisegena*) * Recorded at RSPB Fannyside
Redshank (*Tringa totanus*)
Redwing (*Turdus iliacus*)
Reed bunting (*Emberiza schoeniclus*)

Sand martin (*Riparia riparia*)
Sedge warbler (*Acrocephalus schoenobaenus*) * Recorded at RSPB Fannyside
Short-eared owl (*Asio flammeus*)
Skylark (*Alauda arvensis*)
Snipe (*Gallinago gallinago*)
Songthrush (*Turdus philomelos*) * Recorded at Palacerigg Country Park
Sparrowhawk (*Accipiter nisus*)
Starling (*Sturnus vulgaris*)
Stonechat (*Saxicola rubicola*)
Swift (*Apus apus*)
Taiga bean goose (*Anser fabalis fabalis*) (BAP, SPA & SSSI designated feature)
Tawny owl (*Strix aluco*) * Recorded at RSPB Fannyside
Teal (*Anas crecca*)
Tufted duck (*Aythya fuligula*) * Recorded at RSPB Fannyside
Water rail (*Rallus aquaticus*) * Recorded at RSPB Fannyside
White-fronted goose (*Anser albifrons*)
Wigeon (*Anas penelope*)
Willow warbler (*Phylloscopus trochilus*)
Wheatear (*Oenanthe oenanthe*)
Whinchat (*Saxicola rubetra*)
Whitethroat (*Sylvia communis*) * Recorded at Palacerigg Country Park
White/ pied wagtail (*Motacilla alba*) * Recorded at RSPB Fannyside
Woodcock (*Scolopax rusticola*)
Wood pigeon (*Columba palumbus*)
Wren (*Troglodytes troglodytes*)
Yellowhammer (*Emberiza citronella*) * Recorded at Palacerigg Country Park

**3.3 Mammals**
Badger (*Meles meles*) * Recorded at RSPB Fannyside and Palacerigg Country Park
Bank vole (*Myodes glareolus*) – remains found on site
Brown hare (*Lepus europaeus*)
Common pipistrelle (*Pipistrellus pipistrellus*) * Recorded at RSPB Fannyside
European mole (*Talpes europea*) * Recorded at RSPB Fannyside
European otter (*Lutra lutra*) – scat
Grey squirrel (*Sciurus carolinensis*) Recorded from SWT Forest Wood
Pine martin (*Martes martes*) * Recorded at Palacerigg Country Park
Red fox (*Vulpes vulpes*) –scat & footprints
Roe deer (*Capreolus capreolus*)
Stoat (*Mustela erminea*) * Recorded at RSPB Fannyside
Water vole (*Arvicola amphibious*) * Recorded at Palacerigg Country Park

**3.4 Invertebrates**
**Araneae (spiders)**
Common crab spider (*Xysticus cristatus*)
Cucumber spider (*Araniella sp.*)
Four-spot orb weaver (*Araneus quadratus*)
Garden orb weaver (*Araneus diadematus*)
Grass blade spider (*Tibellus oblongus*)
Lace-webbed spider (*Amaurobius similis*) – carpark area
long-jawed spider (*Metellina mengei*)
long-jawed spider (*Metellina segmentata*)
long-jawed spider (*Tetragnatha extensa*)
long-jawed spider (*Tetragnatha montana*)

money spider (*Gonatium rubens*)
mesh-web spider (*Dictyna sp*)
mesh-web spider (*Dictyna arundinacea*)
orb-weaver spider (*Hypsosinga pygmaea*)
sac spider (*Cheiracanthium erraticum*)
sac spider (*Clubonia trivialis*)
wolf spider (*Pardosa sp.*)
wolf spider (*Pardosa amentata*)
wolf spider (*Pardosa nigriceps*)
wolf spider (*Pardosa palustris*)
wolf spider (*Trochosa ruricola*)

**Coleoptera (beetles)**
Birch leaf roller weevil (*Deporaus betulae*)
Black snail beetle (*Silpha atrata*)
Blue willow beetle (*Phratora vulgatissima*)
click beetle (*Athous haemorrhoidalis*)
click beetle (*Ctenicera cuprea*)
click beetle (*Denticollis lineatus*)
diving beetle (*Agabus bipustulatus*)
diving beetle (*Agabus sturmii*)
diving beetle (*Hydroporus gyllenhalli*)
diving beetle (*Hydroporus erythrocephalus*)
diving beetle (*Hyrdoporus palustris*)
diving beetle (*Stictonectes lepidus*)
ground beetle (*Agonum ericeti*) – bog specialist
ground beetle (*Pterostichus adstrictus*)
ground beetle (*Pterostichus maddidus*)
ground beetle (*Pterostichus niger*)
ground beetle (*Pterostichus rhaeticus*)
Heather beetle (*Lochmaea suturalis*)
Hieroglyphic ladybird (*Coccinella hieroglyphica*)
Larch ladybird (*Aphidecta obliterata*)
leaf beetle (*Phaedon armoraciae*)
leaf beetle (*Phyllotreta flexuosa*)
leaf beetle (*Plagiodera vessicolor*)
leaf beetle (*Neocrepiodera transversa*)
Raspberry beetle (*Byturus tomentosus*)
Red soldier beetle (*Rhagonycha fulva*)
reed beetle (*Plateumaris discolor*)
rove beetle (*Anthophagus caraboides*)
rove beetle (*Platydracus stercorarius*)
rove beetle (*Stenus nitens*)
rove beetle (*Stenus pubescens*)
rove beetle (*Stenus similis*))
Seven-spot ladybird (*Coccinella 7-punctata*)
sexton beetle (*Nicrophorus vespiloides*)
Ten-spot ladybird (*Adalia 10-punctata*)
thick-legged flower beetle (*Oedemera virescens*)
Two-banded longhorn (*Rhagium bifasciatum*)
tumbling flower beetle (*Anaspis thoracica*)
weevil (*Limnobaris dolorosa*)
weevil (*Orchestes rusci*)

weevil (*Phyllobius pyri*)
weevil (*Polydrusus cervinus*)
whirligig beetle (*Gyrinus substriatus*)
whirligig beetle (*Gyrinus caspius*)
Willow leaf beetle (*Lochmaea caprea*)

**Collembola (spring tails)**
globular springtail (*Dicyrtomia minuta*)
globular springtail (*Dicyrtomia saundersi*)

**Dermiptera (earwings)**
Common earwig (*Forficula auricularia*)

**Diptera (flies)**
conopid fly (*Sicus ferrugineus*)
cluster fly (*Pollenia sp.*)
cranefly (*Dolichopeza albipes*)
cranefly (*Idioptera pulchella*)
cranefly (*Limonia mitis*)
cranefly (*Pedica rivosa*)
cranefly (*Tipula paludosa*)
cranefly (*Tipula subnodicornis*)
cranefly (*Ula mollissima*)
dancefly (*Hybos culicormis*)
Deer ked (*Lipoptena cervi*)
Down-looker snipefly (*Rhagio scolopaceus*)
gall midge (*Iteomyia capreae*)
hoverfly (*Cheilosia bergenstammi*)
hoverfly (*Cheilosia grossa*)
hoverfly (*Cheilosia pagana*)
hoverfly (*Chrysotoxum arcuatum*)
hoverfly (*Dasysyrphus venustus*)
hoverfly (*Epistrophe grossulariae*)
hoverfly (*Episyrphus balteatus*)
hoverfly (*Eristalis arbustorum*)
hoverfly (*Eristalis horticola*)
hoverfly (*Eristalis intricarius*)
hoverfly (*Eristalis nemorum*)
hoverfly (*Eristalis pertinax*)
hoverfly (*Eristalis tenax*)
hoverfly (*Eupeodes luniger*)
hoverfly (*Helophilus pendulus*)
hoverfly (*Leucozona lucorum*)
hoverfly (*Melanostoma scalare*)
hoverfly (*Melanostoma mellinum*)
hoverfly (*Myathropa florea*)
hoverfly (*Neoascia tenur*)
hoverfly (*Pipizella viduata*)
hoverfly (*Platycheirus albimanus*)
hoverfly (*Platycheirus granditarsus*)
hoverfly (*Platycheirus occultus*)
hoverfly (*Platycheirus ramsarensis*)
hoverfly (*Platycheirus rosarum*)

hoverfly (*Rhingia campestris*)
hoverfly (*Sericomyia lappona*)
hoverfly (*Sericomyia silentis*)
hoverfly (*Syrphus ribesii*)
hoverfly (*Syritta pipiens*)
hoverfly (*Volucella bombylans*)
marsh flies (Sciomyzidae)
Noon fly (*Mesembrina meridiana*)
picture-wing fly (*Campiglossa argyrocephala*)
picture-wing fly (*Tephritis conura*)
picture-wing fly (*Xyphosia miliaria*)
pipunculid fly (*Verrallia aucta*)
Red-legged St Marks fly (*Bibio pomonae*)
soldierfly (*Beris chalybata*)
St Mark's fly (*Bibio marci*)
tachinid fly (*Gymnochaeta viridis*)
tachinid fly (*Tachina ursina*)
tachinid fly (*Tachina grossa*)
Yellow dung fly (*Scathophaga stercoraria*)

**Ephemeroptera (mayflies)**
Claret dun (*Leptophlebia vespertina*)
Pond olive (*Cloeon dipterum*)

**Hemiptera (true bugs)**
Alder spittlebug (*Aphrophora alni*)
Common froghopper (*Philaenus spumarius*)
Gorse shieldbug (*Piezodorum lituratus*)
ground bug (*Nysius* sp.)
lace hopper (*Cixius nervosus*)
leaf hopper (*Cicadella viridis*)
leaf hopper (*Cicadula quadrinotata*)
leaf hopper (*Idiocerus lituratus*)
leaf hopper (*Conosanus obsoletus*)
Marsh damselbug (*Nabis limbatus*)
Marsh froghopper (*Neophilaenus lineatus*)
Meadow plant bug (*Leptopterna dolabrata*)
mirid plant bug (*Capus ater*)
mirid plant bug (*Orthotylus ericetorum*)
mirid plant bug (*Pithanus maerkelii*)
mirid plant bug (*Stenodema calcarata*)
mirid plant bug (*Stenodema holsata*)
mirid plant bug (*Stenodema laevigata*)
mirid plant bug (*Teratocoris* sp.)
mirid plant bug (*Trigonotylus caelestialum*)
plant hopper (*Conomelus anceps*)
pond skater (Gerris sp.)
pond skater (*Gerris thoracicus*)
Spiked shieldbug (*Picromerus bidens*)
water boatman (*Callicorixa wollastoni)*
water cricket (*Velia caprai*)

**Hymenoptera (ants, bees and wasps)**
ant (*Formica lemani*)
ant (*Lasius niger*)
ant (*Myrmica ruginodis*)
Bedeguar gall wasp (*Diplolepis rosae*)
Buff-tailed bumblebee (*Bombus terrestris*)
Clarke's mining bee (*Andrena clarkella*)
Common carder bumblebee (*Bombus pascuorum*)
Common social wasp (*Vespa vulgaris*)
Cryptic bumblebee (*Bombus cryptarum*)
Early bumblebee (*Bombus pratorum*)
Early mining bee (*Andrena haemorrhoa*)
Field cuckoo bumblebee (*Bombus campestris*)
Forest cuckoo bumblebee (*Bombus sylvestris*)
furrow bees (*Lasioglossum* sp.)
Heath bumblebee (*Bombus jonellus*)
Heather colletes (*Colletes succinctus*)
Honeybee (*Apis mellifera*)
Orange-legged furrow-bee (*Halictus rubicundus*)
Rose pea gall wasp (*Diplolepis nervosa/ eglanteriae*)
Scabious sawfly (*Abia sericea*)
Tree wasp (*Dolichovespula sylvestris*)
White-tailed bumblebee (*Bombus lucorum*)

**Isopoda (woodlice)**
Common striped woodlouse (*Philoscia muscorum*)
Common rough woodlouse (*Porcellio scaber*)

**Lepidoptera (butterflies and moths)**
Angle shades (*Phlogophora meticulosa*)
Antler moth (*Cerapteryx graminis*)
Beautiful yellow underwing (*Anarta myrtilli*)
Bilberry tortrix (*Apheilia viburnana*)
Brindled flat-body (*Agonopterix arenella*)
Broom moth (*Ceramica pisi*)
Brown silver-lines (*Petrophora chlorosata*)
Buff-tip moth (*Phalera bucephala*)
Burnished brass (*Diachrysia chrysitis*)
Canary-shouldered thorn (*Ennomos alniaria*)
Cinnabar moth (*Tyria jacobaeae*)
Common birch pygmy (*Stigmella betulicola*)
Clouded border (*Lomospilis marginata*)
Common carpet (*Epirrhoe alternata*)
Common heath (*Ematurga atomaria atomaria*)
Common grass veneer (*Agriphila tristella*)
Common plume (*Emmelina monodactyla*)
Common rush case-bearer (*Coleophora alticolella*)
Coxcomb prominent (*Ptilodon capucina*)
Dark arches (*Apamea monoglypha*)
Dark marbled carpet (*Chloroclysta citrata*)
Drinker moth (*Euthrix potatoria*)
Elephant hawkmoth (*Deilephila elpenor*)
Emperor moth (*Saturnia pavonia*)

Flame carpet (*Xanthorhoe designata*)
Fox moth (*Macrothylacia rubi*)
Garden grass-veneer (*Chrysoteuchia culmella*)
Garden tiger (*Arctia caja*)
Grey rush case-bearer (*Coleophora glaucicolella*)
Green carpet (*Colostygia pectinataria*)
Green hairstreak (*Callophrys rubi*)
Green-veined white (*Pieris napi*)
Haworth's minor (*Celaena haworthii*)
Heath rustic (*Xestia agathina*)
Heath twist (*Philedonides lunana*)
Hebrew character (*Orthosia gothica*)
Hook-streaked grass-veneer (*Crambus lathoniellus*)
July highflyer (*Hydriomena furcata*)
Large white (*Pieris brassicae*) * Recorded at RSPB Fannyside
Large yellow underwing (*Nocta pronuba*)
Latticed heath (*Chiasmia clathrata*)
Lempke's gold spot (*Plusia putami gracilis*)
Lesser broad-bordered yellow underwing (*Noctua janthe*)
Lesser yellow underwing (*Noctua comes*)
Little cosmet (*Mompha raschikiella*)
Lunar hornet moth (*Sesia bembeciformis*)
Manchester treble-bar (*Carsia sororiata*)
Marbled conch (*Eupoecilia angustana*)
Meadow brown (*Maniola jurtina*)
Mottled beauty (*Alcis repandata*)
Narrow-winged pug (*Eupithecia nanata*)
Northern eggar (*Lasiocampa quercus callunae*)
Northern spinach (*Eulithis populata*)
Orange tip (*Anthocharis cardamines*)
Orange underwing (*Archiearis parthenias*)
Painted lady (*Vanessa cardui*) * Recorded at RSPB Fannyside
Plain gold (*Micropterix calthella*)
Peacock (*Aglais io*)
Pearl-banded grass veneer (*Catoptria margaritella*)
Poplar hawkmoth (*Laothoe populi*)
Red admiral (*Vanessa atalanta*)
Red sword grass (*Xylena exsoleta*)
Ringlet (*Aphantopus hyperantus*)
Rush marble (*Bactra lancealana*)
Sallow (*Cirrhia icteritia*)
Scarce silver Y (*Syngrapha interrogationis*)
Silver-ground carpet (*Xanthorhoe montanata*)
Silver Y (*Autographa gamma*)
Six-spot burnet (*Zygaena filipendulae*)
Small copper (*Lycaena phlaeas*)
Small heath (*Coenonympha pamphilus*)
Small pearl-bordered fritillary (*Boloria selene*)
Small tortoiseshell (*Aglais urticae*)
Small white (*Pieris rapae*)
Spruce carpet (*Thera britannica*)
Straw dot (*Rivula sericealis*)
True lover's knot (*Lycophotia porphyria*)

White ermine (*Spilosoma lubricipeda*)
White blotch bell (*Epinotia trigonella*)
White sallow bell (*Epinotia subocellana*)
Woodland marble (*Orthotaenia undulana*)
Yellow-barred gold (*Micropterix aureatella*)
Yellow shell (*Camptogramma bilineata*)
Vapourer (*Eupithecia nanata*)
Winter moth (*Operophtera brumata*)

**Lithobiomorpha (stone centipedes)**
Common brown centipede (*Lithobius forficatus*)

**Mecoptera (scorpion flies)**
scorpionfly (*Panorpa germanica*)

**Megaloptera (alderflies)**
Common alderfly (*Sialis lutaria*)

**Molluscs (slugs and snails)**
Black slug (*Arion ater*)
Dusky slug (*Arion subfuscus*)
Marsh slug (*Derocerus laeve*)

**Myriapods (centipedes and millipedes)**
Black snake millipede (*Tachypodoiulus niger*)

**Neuroptera (lacewings)**
green lacewing (*Chrysopa pallens*)
green lacewing (*Chrysopa perla*)

**Odonata (dragonflies and damselflies)**
Azure damselfly (*Coenagrion puella*) * Recorded at Palacerigg Country Park
Black darter (*Sympetrum danae*)
Blue-tailed damselfly (*Ischnura elegans*)
Common blue damselfly (*Enallagma cyathigerum*)
Common darter (*Sympetrum striolatum*) * Recorded at RSPB Fannyside
Common hawker (*Aeshna juncea*)
Emerald damselfly (*Lestes sponsa*)
Four-spotted chaser (*Libellula quadrimaculata*)
Golden-ringed dragonfly (*Cordulegaster boltonii*) * Recorded at RSPB Fannyside
Large red damselfly (*Pyrrhosoma nymphula*)

**Opiliones (harvestmen)**
harvestman (*Mitopus morio*)
harvestman (*Parologolophus agrestis*)

**Orthoptera (grasshoppers and crickets)**
Common green grasshopper (*Omocestus viridulus*)

**Plecoptera (stoneflies)**
Early needle fly (*Leuctra hippopus*)
Small brown stonefly (*Nemoura cinerea*)

## 3.5 Reptiles and Amphibians

**Reptiles**

Adder (*Vipera berus*) *Recorded at SWT Forest Wood
Common lizard (*Zootoca vivipara*)

**Amphibians**

Common frog (*Rana temporaria*)
Common toad (*Bufo bufo*)
Palmate newt (*Lissotriton helveticus*) * Recorded at Palacerigg Country Park
Smooth newt (*Lissotriton vulgaris*) * Recorded at Palacerigg Country Park

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