



Slamannan Bog Restoration Project

Year 4 Report

1st November 2018

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Saving the small things that run the planet

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Left: Various *Sphagnum* sp., Centre: Common hawkker (*Aeshna juncea*) Right: Round-leaved sundew (*Drosera rotundifolia*).

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, 3 kilometres from Cumbernauld.

The project is managed by Buglife Scotland in partnership with landowners Forest Enterprise Scotland (FES), North Lanarkshire Council (NLC), Scottish Wildlife Trust (SWT) and additional stakeholders Royal Society for the Protection of Birds (RSPB), Cumbernauld Living Landscape (CLL) 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 fourth year of the project is summarised below:

- No further re-wetting works were carried out in the last 12 months, but approximately 50 regenerating Lodgepole pines and 4 small Sitka spruce were cleared with hand tools.
- Monitoring of the site included monthly hydrological monitoring of the 32 dipwells across the site, checking 7 fixed vegetation monitoring quadrats and fixed-point photographs of 32 mini vegetation quadrats, aquatic invertebrate surveys and other invertebrate surveys.
- To monitor the response of key indicator species to the restoration work, surveys were carried out looking at the distribution of Black darter dragonfly nymphs (*Sympetrum danae*) and the *Sphagnum*-associated ground beetle (*Agonum ericeti*).
- Two small grass fires occurred along the verge of Fannyside Road (which cuts through the project site) in May and June 2017. Just over 0.18 ha of verge and some heather was burnt by the fire. Surrounding blocked ditches and re-wetted areas limited the spread of the fire.
- A total of 835 species have been recorded on the site since the start of the project.

1. Introduction

This report summarises the fourth 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), Forest Enterprise Scotland (FES), 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 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, 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 builds 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 4

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 re-establishment 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 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 20 years having passed since commercial peat milling ceased at Fannyside Muir, areas of bare peat still evident across the site due to the peat surface becoming waterlogged 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.

Broadleaf scrub and regenerating conifers were removed as they increase nutrients, damage the bog surface and further dry out the bog through transpiration. 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 (outwith FES-owned land) were carefully treated with herbicide to prevent re-growth in line with Scottish Natural Heritage specifications. All work with herbicide and machinery including excavators, brush cutters and chainsaws was carried out by experienced contractors to avoid any damage to the peat moss surface and to comply with FC and FISA guidance.

All of the work within, and near to 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 and to protect, or enhancing habitat for the existing SSSI and SPA designated features of the bog (see Objective 2)

Prescriptions:

1.1 Ground reprofiling with low ground pressure machine

No further attempts at cross-tracking were carried out in year 4 of the project

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. No additional dams were added in 2018.

1.2.1 Plastic piling dams

No additional plastic piling dams were added in 2018. During hydrological monitoring visits in June 2018, the water height behind a number of the plastic piling dams was observed to be low compared to other dams along the same ditch, suggesting that the dams were not holding water. The leaking dams were mainly along a large old ditch, and leakage was attributed to peat cracks, although a number of dams were noted that would benefit from the addition of further piles to extend dams.

1.2.2 Peat dams

No additional dams were added in 2018, and installed peat dams from the first 3 phases of work are looking good, with signs of vegetation cover, including *Sphagnum* colonisation.

1.2.3 Reprofiling the sides of large ditches

No further ditch reprofiling was undertaken in 2018.

1.2.4 Reducing water evaporation from ditches with bundles of cut heather

No further heather cutting was carried out in 2018, but the area cut in September 2017 has maintained higher ground water levels than surrounding areas.

1.2.5. Use of cell bunds to block ditches and retain surface water

No further cell bunds were added in the last year. Trench cell-bunds that were installed in previous phases were working well and there has been a notable increase in cottongrass and aquatic *Sphagnum* colonisation across areas with cell-bunding.

1.3 Scrub removal

1.3.1 Felling and treatment of broad leaf scrub and conifers

No large trees were felled during the 2017/2018 period.

1.3.2 Hand pulling of small scrub with volunteers

Around 55 regenerating Lodgepole pines and small Sitka spruce were removed from across Fannyside Muir using hand tools during 2018.

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 on the Slamannan Plateau between October and February. Management objectives for the SPA state that it is essential to avoid deterioration of the bog habitat 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 Muir in winter may provide additional winter roosting pools beyond those currently used by the bean geese.

Prescriptions:

2.1 Enhancing habitat for roosting Taiga bean geese at Fannyside Muir

The only habitat enhancement work carried out during year 4 of the project was the removal of small regenerating Lodgepole pines and Sitka spruce seedlings from the bog surface. It appears that the Slamannan flock of Taiga bean geese have continued to make use of the restoration site as a winter roosting location. Wetland birds including Snipe, Redshank, Curlew, Mallard, Teal, Canada goose, Reed bunting, Sedge warbler and Grasshopper warbler were observed to be breeding within the restored areas of the project site in spring/summer of 2018.

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

No restoration work with heavy machinery was carried out during year 4 of the project.

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

No restoration work was carried out during year 4 of the project.

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

No machinery or infrastructure was present on site during year 4 of the project.

2.5 Use of heavy machinery and equipment on the site

No heavy machinery and equipment were used on site during year 4 of the project

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 Action 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. Four geese were fitted with GPS transmitter tags by BTO staff on the 9th of October 2015 to help monitor their movements. One of the tagged geese died in Sweden in the summer of 2018, and the transmitter of another appears to have stopped working in early 2018. It has been encouraging to see that the geese are continuing to frequent the roost pools within compartment 11 after feeding/loafing in surrounding agricultural fields during the day. It therefore appears that the restoration work on the site has had no negative impact on the geese using the site.

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. (see Table 4, Appendix iii for summary of monthly hydrology monitoring data)

3.2.1 Water loggers

Three hydrological data loggers were installed on the site in September 2014 on behalf of SNH. Water level data is collected every 30 minutes and data is sent automatically once per week. Maintenance is contracted out by SNH. This data will be made publically available on Scotland's Environment Web (SEWeb).

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. Each compartment generally has at least 2 dipwells, with one within 0.5 m of a major ditch and another approximately 25m from the first.

Dipwells consist of a 1.5 m long pipe of 50 mm 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 (see Appendix iii Table 4).

3.2.3 Checking integrity of installed dams

The integrity of peat dams and plastic piling dams has been checked regularly after installation to assess their effectiveness in raising ditch water levels, and any issues with leakage identified. During an annual survey of dam integrity in June 2018 a number of dams were identified where water level was below ground level on the face of the dams. This was after a prolonged drought; however other dams on the same ditch were holding water. These leaking dams will be monitored further to check that further interventions are not required.

3.3 Peat surveys

3.3.1 Peat depth survey

Peat depth surveys to help estimate the volume of peat within the project area were carried out during 2016.

3.3.2 Peat stability monitoring survey

No heavy machinery was present on site during 2018, so the risk of a bog burst or peat slide was very low, however some peat surface cracking was noted during site visits in June and July 2018. This was following 3 months of low rainfall.

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.

3.5 Bog vegetation monitoring

3.5.1 Fixed-point vegetation quadrat transects

Seven 2 m x 2 m vegetation monitoring quadrats were installed across the restoration site in spring 2015. These will be monitored on an annual basis 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 1 for Vegetation Quadrat locations)

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

Table 1. Locations of vegetation monitoring quadrats

During hydrological monitoring of dipwells, 32 mini vegetation quadrats (0.5 m x 0.5 m) were recorded at the position of each of the dipwells to enable vegetation change to be compared to any hydrological changes. Data collected included a photograph and % coverage of 'thin-stem' vs 'thick-stem' *Sphagnum*s, graminoids, cotton grasses and *Calluna vulgaris*. (See Figure 5 for example photographs and Appendix iii Table 5 for mini-quadrat data).

3.5.2 Annual survey of broadleaf scrub and conifer regeneration

During monthly visits to monitor water levels, the presence of regenerating broadleaf scrub and conifers was noted so that they can be removed by contractors or volunteer work parties. Around 50 small birch and Lodgepole pine samplings were identified and removed during monthly hydrological surveys. During the hydrological monitoring visit in June, evidence of two small grass fires was noted along the verge of Fannyside Road. These had both occurred between the May and June hydrological visits. Approximately 0.18 ha of verge and some heather had been burnt. Growth of fresh Purple moor grass was noted through the charred vegetation.

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 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.

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*). A timed count was carried out during June and July 2018, 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. Small Pearl-bordered fritillary was recorded at 3 locations on Fannyside Muir, and a number of locations just outside the project site during June and July 2018.

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.

3.6.1 Bog sun-jumper spider (*Heliophanus dampfi*)

No specific surveys for Bog sun-jumper were carried out at Fannyside Muir during 2018.

3.6.2 Light trapping for moths

No light trapping was carried out at Fannyside Muir during 2018, although a number of new species were recorded from adults, caterpillars, and leaf mines observed during the last year.

3.6.3 Other species surveyed

3.6.3.1 Black darter surveys at Fannyside Muir

During early July 2018 aquatic sampling was carried out across Fannyside Muir and surrounding areas to look for evidence of the colonisation of Black darters (*Sympetrum danae*) in restored areas of bog habitat. Standardised sampling (in triplicate) with pond nets was carried out before emergence of the adults, so that nymphs would be present in breeding pools. (See Figure 1). A variety of habitats in 17 locations were targeted including ponds on mineral substrate (non-peat), standing bog pools on peat (blocked ditches and cell-bunded areas), and running water in ditches in cut-over bog (See Table 2). In summary, Black darter larvae were found in all standing peaty-water sampled within the project site, including recently blocked ditches, but not in open ditches with running water. A single larvae was found in a 'mineral/ non-peat' pool at the edge of Wester Fannyside SSSI, but in general this species was absent from such pools. This suggests that colonisation likely occurred from populations using existing bog pools surrounding the project site (See Maps 7 and 8). Due to safety concerns it was not possible to sample from the 'goose roost pools' in Compartment 11, however Black darter larvae have previously been recorded from these pools.

	OS Grid Ref	Habitat Description	Black darters	Other dragonflies	damselflies
1	NS7862973894	Vegetated pool on mineral	-	-	46
2	NS7879574038	Blocked ditch on peat	10	5	28
3	NS7887874063	Blocked ditch on peat	32	2	19
4	NS7949473645	Cell-bunded pools on peat	16	-	1
5	NS7897572926	Pool on mineral	-	5	142
6	NS7933672860	Cut-over degraded bog	-	-	-
7	NS7973372724	Pool on mineral	1	-	6
8	NS8026173817	Cell-bunded pools on peat	30	3	22
9	NS8033774010	Blocked ditches on peat (shaded by gorse)	5	1	-
10	NS8020773892	Blocked ditches on peat	32	2	5
11	NS8024874736	Blocked ditch on peat (ex-forestry area)	5	1	2
12	NS8020274894	Blocked ditch on peat (ex-forestry area)	38	3	13
13	NS8041175039	Forestry ditch- unblocked. On mineral	-	-	-
14	NS7972275031	Forestry ditch- unblocked. On peat (degraded)	-	-	7
15	NS7962874924	Blocked ditch in peat	25	1	13

16	NS7985574599	Blocked ditch in peat	17	4	16
17	NS8065273720	RSPB Fannyside Loch	-	1	14

Table 2: Black darter (*Sympetrum danae*) distribution surveys at Fannyside Muir.

3.6.3.2 *Agonum ericeti* surveys at Fannyside Muir

Pitfall transects were installed across Fannyside Muir in 2015 to collect data on beetles and spiders across the restoration site. Another phase of pit-fall trapping was carried out between May and August 2018 to see if the *Sphagnum*-associated ground beetle *Agonum ericeti* had responded to restoration work by moving into restored areas. The results of the survey are shown in Table 3. In summary, this peatland indicator species was found quite widely across the site. An interesting observation was that more were present in the area where heather had been cut and lifted in September 2017. This area is wetter than it had been previously (data from surrounding dipwells), and the surface is more exposed with tall heather removed (Compartment 7). Slightly higher numbers were also observed in flat wet area of Compartment 6 where forestry plough-furrows had been blocked in 2016. This area has a good carpet of *Sphagnum* and slightly less heather than further north in this compartment (See Map 8). Further surveys are required to clarify the microhabitat usage and distribution of this species at Fannyside and other sites undergoing restoration.

	OS Grid Ref	Habitat Descriptions	<i>Agonum ericeti</i>
1	NS8029973778	Previously burnt area near cell-bunding	1
2	NS8029273770	Lagg fen area near road/ carpark with <i>Molinia</i> tussocks.	-
3	NS8021673938	Recovering peat milled area, with blocked ditches	1
4	NS8025673909	Raised railway bund surrounded by blocked ditches	-
5	NS7993874121	Raised railway bund, surrounded by blocked ditches-wet area	2
6	NS8022674482	Plough furrows – flat area blocked ditches	3
7	NS8023474578	Plough furrows – dry peatland, blocked ditches	-
8	NS8024174829	Access track through middle of forestry plough furrows – <i>Sphagnum</i> present in wet hollows on slope, blocked ditches	1
9	NS7991074556	Heather – cut area, blocked ditches	5
10	NS8010874330	Peat milled area – wet, blocked ditches	-
11	NS7980373192	Raised bog, near natural	3
12	NS7933372874	Cut-over, drained peatland with open ditches	-

Table 3: *Sphagnum* beetle (*Agonum ericeti*) distribution surveys at Fannyside Muir.

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 social media posts including blogs and Twitter updates were produced throughout the year to promote the work at Fannyside Muir and raise awareness of our peatlands.

4.2 Educational visits

As part of the 2018 Year of Young People, North Lanarkshire Council ran a 'Riggfest' day of environmental activities in July 2018 at Palacerigg Country Park and Fannyside Muir. Buglife delivered three 90 minute 'Bog Bioblitz' sessions with 49 young people aged 6-14 years. During each session, the young people were given a quick introduction to the importance of peatlands and particularly bog and fen habitats at Fannyside Muir. Each group learned invertebrate survey techniques including pond-dipping and sweep-netting - with a competition to find the most species. Other activities delivered on the day involved a nature hike lead by a mountaineering guide, who led groups of young people across parts of Fannyside Muir.

4.3 Community engagement activities

In addition to local school visits, local community engagement activities this year have included delivering guided walks on site and running volunteer work parties.

4.3.1 Walks and talks.

Talks to raise awareness of peatlands and the restoration project at Fannyside Muir have been given to local organisations including the Falkirk Natural History and Archaeology Group in December 2017, and an international audience at the 'Bringing Bugs back to LIFE' conference in Stirling in September 2018.

4.3.2 Volunteer recruitment and training workshops.

Volunteers helped with hydrology monitoring at Fannyside Muir during April and July 2018. In early July volunteers also helped with Black darter dragonfly surveys at Fannyside Muir and the surrounding area to look for colonisation of this species into newly restored bog habitat.

D: 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. Site visits and meetings with stakeholders were held throughout 2015, 2016 and 2017 to discuss restoration work.

5.2 Annual review of project implementation

A review of progress on the implementation of objectives and prescriptions to deliver the management plan has taken place annually. This ensures that management techniques are delivering the anticipated results and allows 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 has been assessed annually.

5.4 Comply with all relevant legislation

All restoration work carried out within the Slamannan Plateau SSSI and SPA boundaries at Fannyside Muir has undergone an appropriate assessment carried out by SNH, and the restoration work was given consent prior to work beginning on the site. The assessment process helps to minimise the risk of any of the interventions having a negative impact on the designated features of the Slamannan Plateau SSSI and SPA.

5.5 Maintain site species lists (all taxa)

A total of 835 species have been recorded at Fannyside Muir, and surrounding sites 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 4:

(A full list of species recorded at Fannyside Muir is given in the appendix)

Flora and Fungi

A total of **147** vascular plants and **36** lower plants and fungi have been recorded at Fannyside Muir this year, including **18** mosses, **10** fungi, **6** lichens and **2** slime moulds and **1** club-moss.

Notable bog-associated plants 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*)
Crowberry (*Empetrum nigrum*)
Deer grass (*Trichophorum cespitosum*)
Hare's-tail cottongrass (*Eriophorum vaginatum*)
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*)
Fir club-moss (*Huperzia selago*)
Lustrus bog-moss (*Sphagnum subnitens*)
Magellanic bog-moss (*Sphagnum magellanicum*)
Papillose bog-moss (*Sphagnum papillosum*)
Soft bog-moss (*Sphagnum tenellum*)
Strict haircap moss (*Polytrichum strictum*)

Birds:

A Total of **83** species of birds have been recorded at Fannyside Muir since the start of monitoring in 2014 (and a further 10 just outside the site). During the spring of 2016, daily surveys for nest building activity were carried-out while the second phase of restoration work was underway (March- May). Records of **14** breeding species (singing & courtship, nest building, feeding young, and presence of newly fledged birds) were recorded during site visits in 2018. Amber-listed or Red-listed species in the Birds of Conservation Concern List (BoCC) (Eaton *et al.* 2009) are indicated.

Breeding species recorded in 2018

Canada goose (*Branta canadensis*)
Cuckoo (*Cuculus canorus*) (Red listed)
Curlew (*Numenius arquata*). (Amber listed)
Mallard (*Anas platyrhynchos*) (Amber listed)
Meadow pipit (*Anthus pratensis*) (Amber listed)
Redshank (*Tringa tetanus*). (Amber listed)
Reed bunting (*Emberiza schoeniclus*) (Amber listed)
Skylark (*Alauda arvensis*). (Red listed)
Snipe (*Gallinago gallinago*) (Amber listed)
Sedge warbler (*Acrocephalus schoenobaenus*)
Teal (*Anas crecca*) (Amber listed)
Willow warbler (*Phylloscopus trochilus*). (Amber listed)
Wren (*Troglodytes troglodytes*)

Non-breeding notable species recorded in 2017/ 2018

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 1990s which has increased in recent years to around 220-300 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 geese arrived on the Slamannan Plateau on the 7th October 2017, with at least 214 individuals reported. They left for their breeding grounds in Scandinavia between 16th and 21st February 2018. It was confirmed during the summer of 2018 that one of the 4 radio-collared birds had died in Sweden.
Fieldfare (*Turdus pilaris*) (Red listed)
Herring gull (*Larus argentatus*). (Red listed)
Lapwing (*Vanellus vanellus*). (Red listed)
Redwing (*Turdus iliacus*) (Red listed)

Starling (*Sturnus vulgaris*). (Red listed)
Woodcock (*Scolopax rusticola*) (Red listed)
Other species (including Amber-listed species) are listed in the appendices.

Mammals:

A total of **14** species of mammal have been recorded at Fannyside Muir since the start of the project.

Mammal species recorded at Fannyside Muir in 2018:

European mole (*Erinaceus europeaus*) – mole hills
Red fox (*Vulpes vulpes*) – scat & footprints
Roe deer (*Capreolus capreolus*)

Amphibians and Reptiles:

A total of **3** amphibian species and **1** reptile species have been recorded at Fannyside Muir since the start of the project.

Amphibian and reptile species recorded at Fannyside Muir in 2018:

Common frog (*Rana temporaria*)
Common toad (*Bufo bufo*)
Common lizard (*Zootoca vivipara*)

Invertebrates:

A total of **552** invertebrate species have been recorded from Fannyside Muir since the start of the project including **203** species of moths & butterflies, **92** flies, **87** beetles, **49** spiders, **38** true bugs, **34** ants, bees, sawflies & wasps, **9** dragonflies & damselflies, **8** slugs & snails, **4** caddisflies, **3** millipedes, **4** springtails, **3** woodlice, **2** grasshoppers, **2** harvestmen, **2** mites, **2** lacewings, **2** mayflies, **2** stoneflies, **1** alderfly, **1** centipede, **1** earwig, **1** pseudoscorpion, **1** earthworm and **1** scorpionfly.

Notable Invertebrate species recorded at Fannyside include:

Autumnal rustic (*Eugnorisma glareosa*) Scottish Biodiversity List
Blaeberry bumblebee (*Bombus monticola*) Scottish Biodiversity List
Broom moth (*Ceramica pisi*) Scottish Biodiversity List
Cinnabar (*Tyria jacobaeae*) Scottish Biodiversity List
caddisfly *Limnephilus griseus* – Nationally Scarce
caddisfly *Rhadicleptus alpestris* – Nationally Scarce
cranefly *Idioptera pulchella*- Nationally Notable – peatland
cranefly *Phalacrocer replicata* – Nationally Notable
Dark brocade (*Mniotype adusta*) Scottish Biodiversity List
diving beetle *Rhantus suturellus* – Scottish Biodiversity List
diving beetle *Stictonectes lepidus* Scottish Biodiversity List; IUCN Near threatened
Garden Tiger (*Arctia caja*) - UKBAP (Research Only)
Green brindled-crescent (*Allophytes oxyacanthae*) Scottish Biodiversity List
Grey dagger (*Arconicta psi*) Scottish Biodiversity List;
ground beetle (*Agonum ericeti*) Nationally Scarce (bog indicator species)
ground beetle (*Bembidion stephensi*) – Nationally Scarce
Haworth's minor (*Celaena haworthii*) Scottish Biodiversity List;
Heath rustic (*Xestia agathina*) Scottish Biodiversity List
Heather colletes (*Colletes succinctus*) IUCN Near threatened
Knot grass (*Acronicta rumicis*) Scottish Biodiversity List
Latticed heath (*Chiasmia clathrata*) Scottish Biodiversity List
Hairy weaver (*Bathyphantes setiger*)- Nationally Scarce

Floronia spider (*Floronia bucculenta*) – Nationally Scarce
Triangle hammock-weaver (*Saaristoa firma*) Nationally Scarce & Scottish Biodiversity List
Unicorn spider (*Walckenaeria unicornis*) – local
Neglected rustic (*Xestia castanea*) Scottish Biodiversity List
Northern sawfly mining-bee (*Andrena ruficrus*) - RDB3 and Scottish Biodiversity List
Powdered quaker (*Orthosia gracilis*) Scottish Biodiversity List
Sallow (moth) (*Xanthia ictertia*) Scottish Biodiversity List
Shaded broad-bar (*Scotopteryx chenopodiata*) Scottish Biodiversity List
Small heath (*Coenonympha pamphilus*) Scottish Biodiversity List
Small pearl-bordered fritillary (*Boloria selene*) Scottish Biodiversity List
Small square-spot (*Diarsia rubi*) Scottish Biodiversity List;
tumbling flower beetle *Anaspis thoracica* – Nationally Scarce
White ermine (*Spilosoma lubricipeda*) Scottish Biodiversity List
Yarrow picture-wing fly (*Campiglossa argyrocephala*) – RDB3

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 Network (NBN) Atlas 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.

Acknowledgements

Buglife Scotland would like to thank everyone who has contributed their support and advice during the fourth year of the Fannyside Muir Bog Restoration Project including all the volunteers that have helped since the start of the project, staff from Forest Enterprise Scotland, Scottish Wildlife Trust, North Lanarkshire Council, Butterfly Conservation Scotland, RSPB, Cumbernauld Living Landscape, Caledonian Conservation Ltd, East Ayrshire Coalfield Initiative and Scottish Natural Heritage.

Thank you!

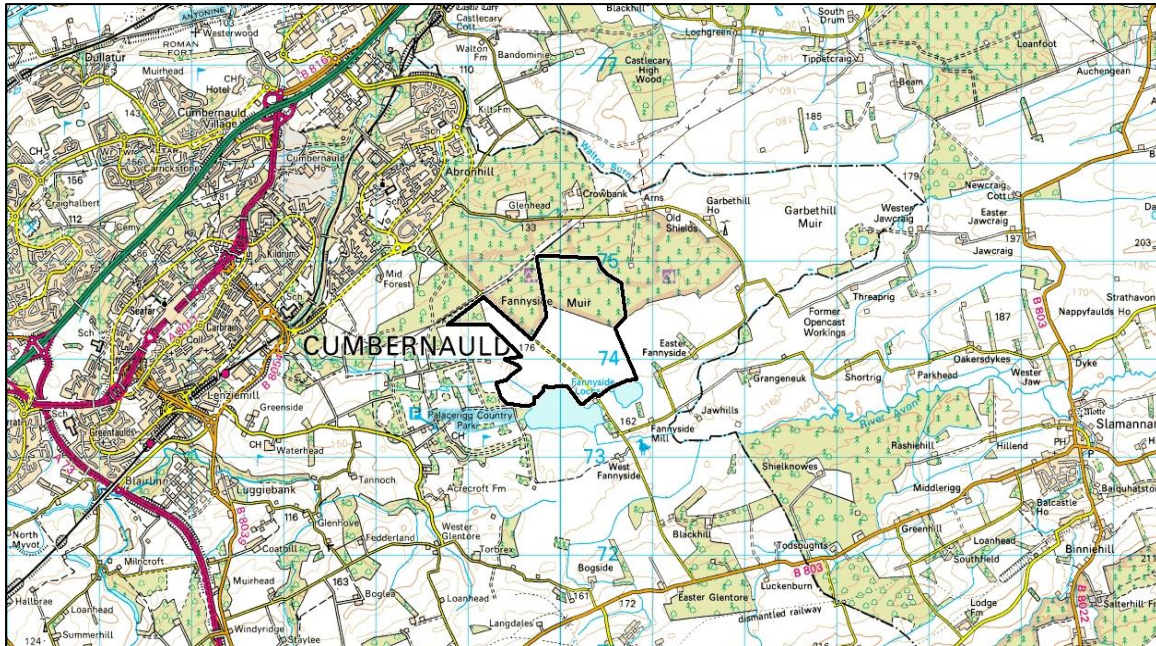
Projects Planned to Occur During the Life of the Plan

The numbers refer to priority, 1 being essential and 2 highly desirable. Yellow: achieved. Orange: partially achieved. Red: not achieved.

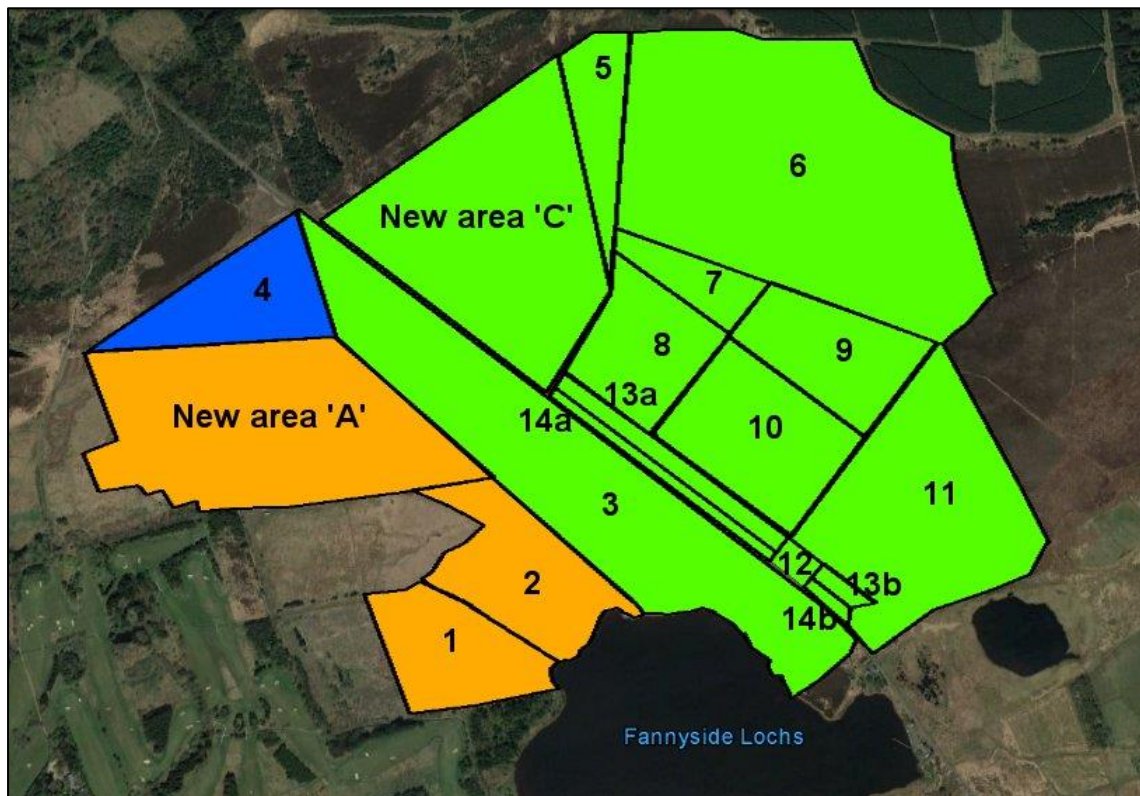
Code	Project	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
1.1	Use of low ground-pressure machine to cross-track bog surface	1	2								
1.2.1	Dam Installation (plastic piling)	1	1								
1.2.2	Dam Installation (peat dams)	1	1								
1.2.3	Reprofile sides of steep primary ditches	2	2								
1.2.4	Reducing water evaporation from ditches with heather bundles	2	2	2							
1.3.1	Felling and treatment of broadleaf scrub & conifers	1	1		2		2		2		2
1.3.2	Hand pulling of small broadleaf scrub & conifers with volunteers	1	1	1	1		2		2		2
1.3.3	Conservation grazing					2	2	2	2	2	2
2.1	Enhancing habitat for roosting geese at Fannyside Muir	1	1	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						
2.4	Sensitive use of heavy machinery on site	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	2	2	2	2	2	2
3.3.1	Peat depth survey	2	2	1							
3.3.2	Peat stability monitoring	1	1	1	2						2
3.4	Fixed-point photography to monitor condition of bog	1	1	1	1		2				2

3.4.1	Bog vegetation monitoring – Fixed-point quadrat transects	1	1	1	1						
3.4.2	Annual survey of broad leaf scrub	1	2	2	2						
3.5.1	Butterfly transect - Large Heath	1	1	1	1						
3.5.2	Butterfly transect - Small pearl-bordered fritillary	1	1	1	1	2	2	2	2	2	2
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						
4.1	Educational activities (50 young people engaged per year)	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						
5.2	Annual review of project implementation	1	1	1	1						
5.3	Revise the management plan					2					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						
5.6	Produce connectivity maps for key bog species	1	1	1	2						
5.7	Ensure all species records regularly added to NBN	2	2	2	2						

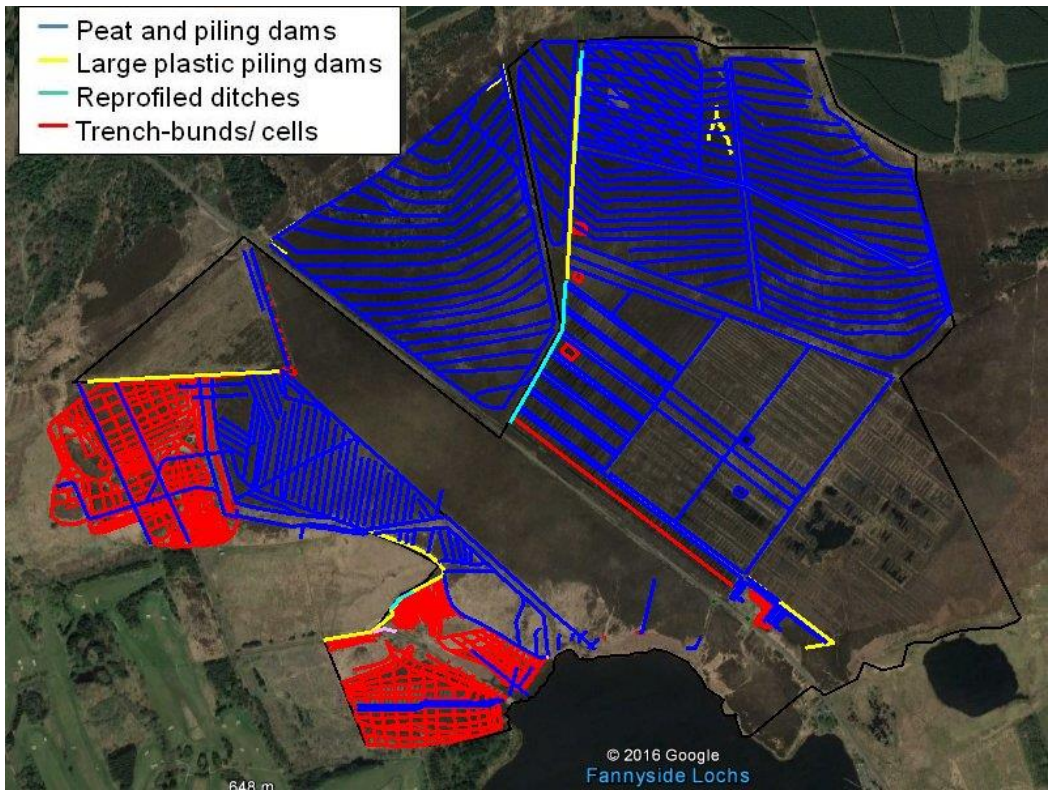
Appendix i. Maps



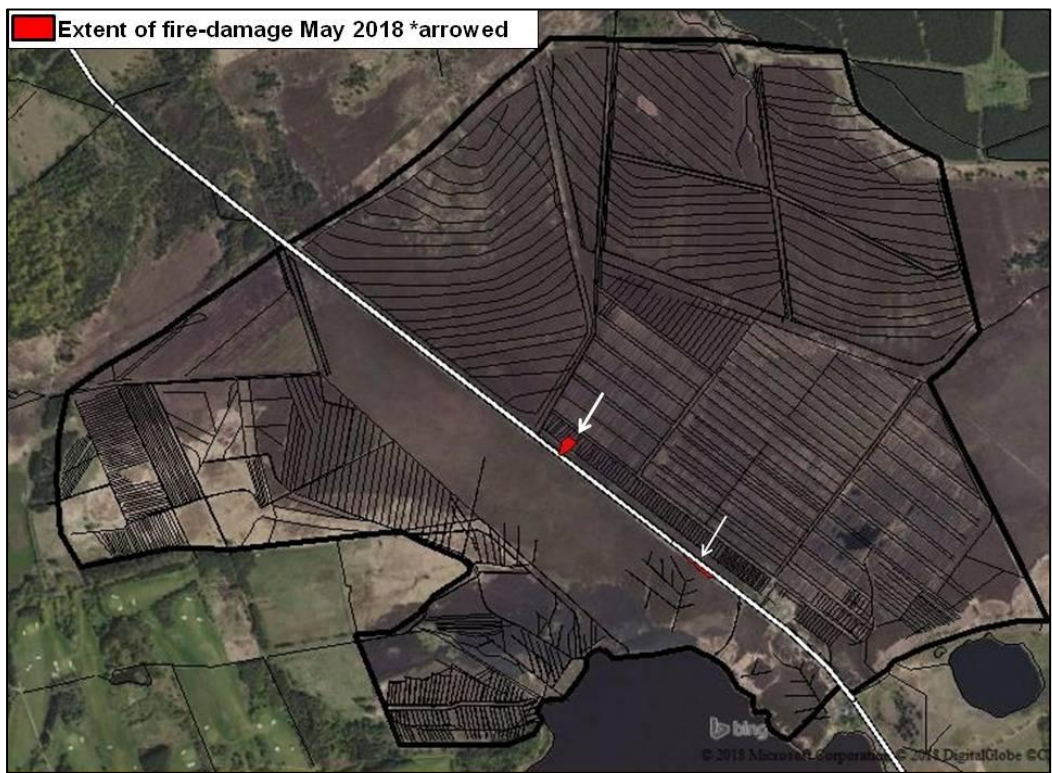
Map 1: Location of Fannyside Muir bog restoration site
Core project area outlined in black. 3km east of Cumbernauld on the Slamannan Plateau.



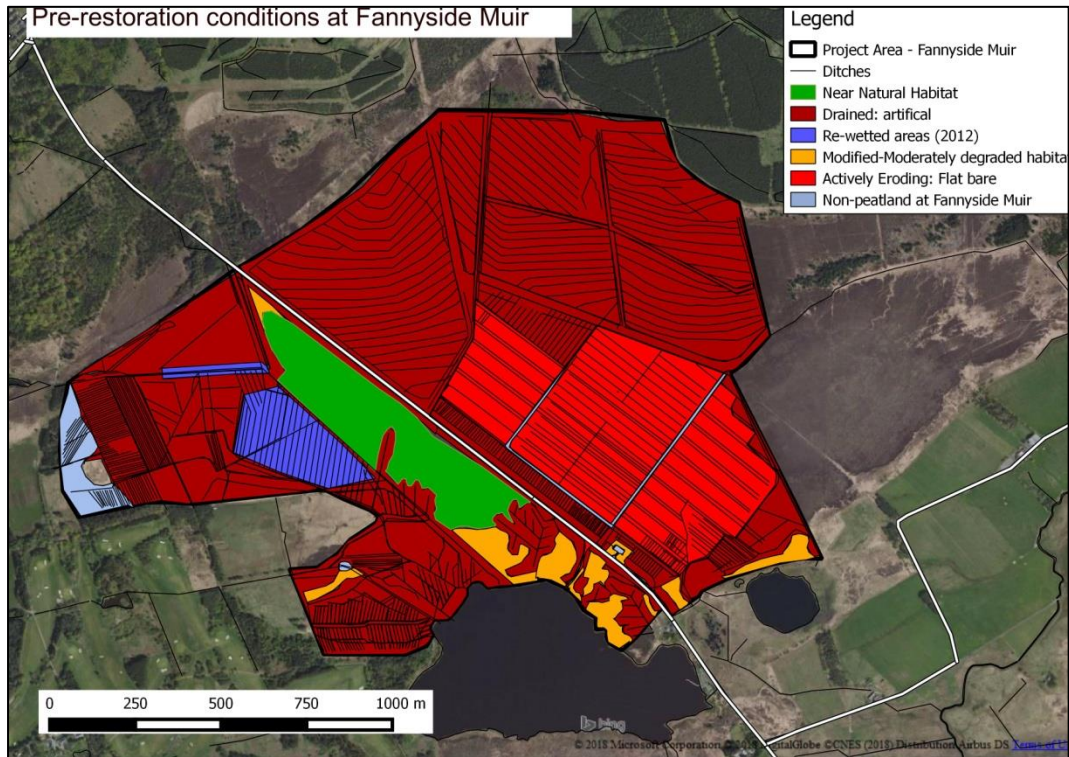
Map 2: Compartments and land ownership within restoration area.
North Lanarkshire Council (NLC) in orange; Forest Enterprise Scotland (FES) in green and Scottish Wildlife Trust (SWT) in blue. Numbers relate to Compartments mentioned in the Management Plan.



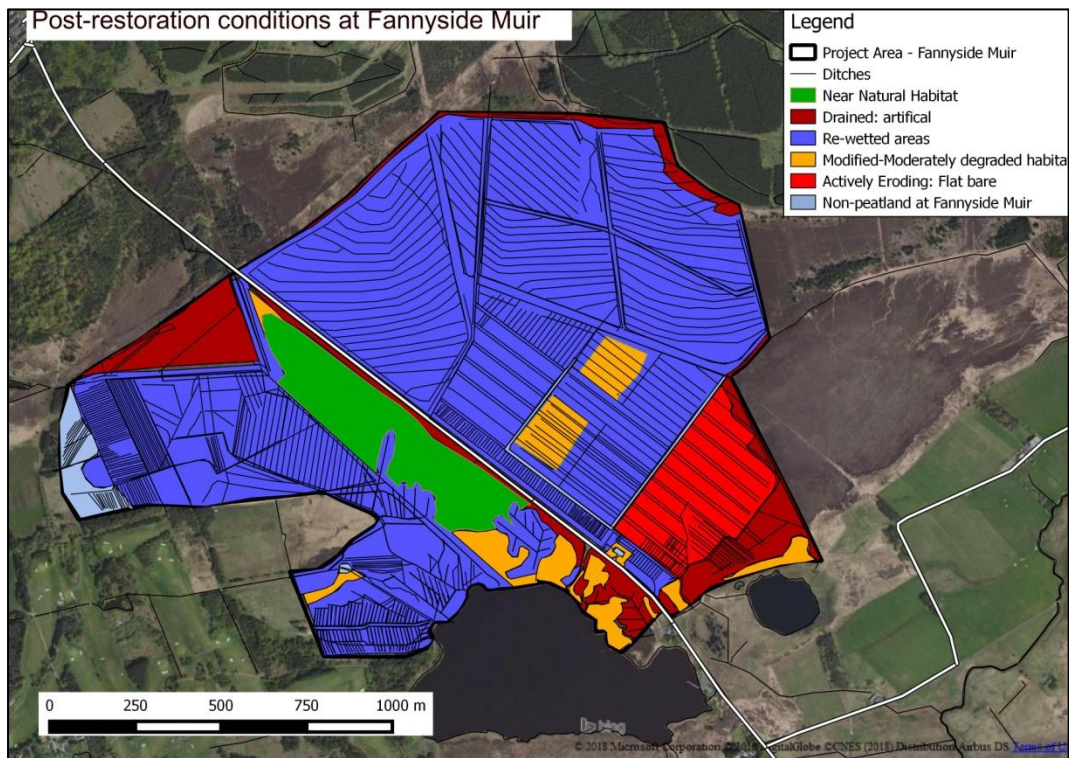
Map 3. Overview of restoration work carried out at Fannyside Muir (dams and bunds).



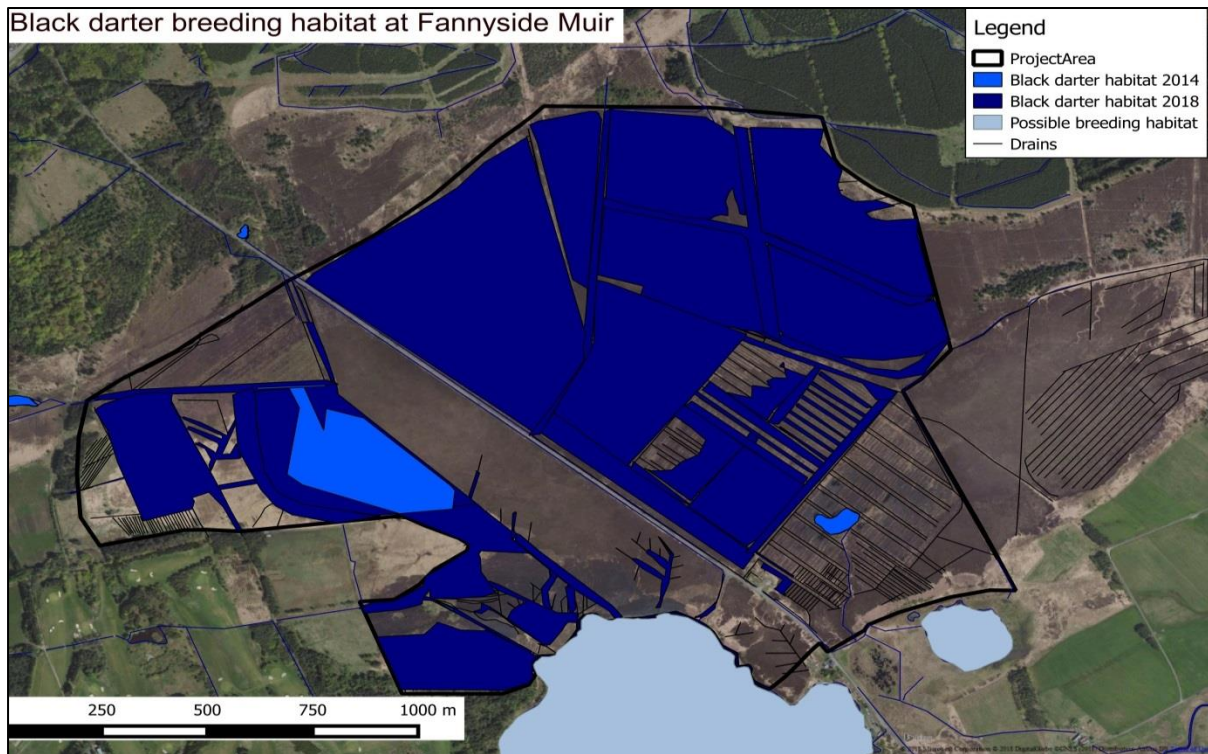
Map 4. Location of fire-damage along edge of Fannyside Road during 2018.



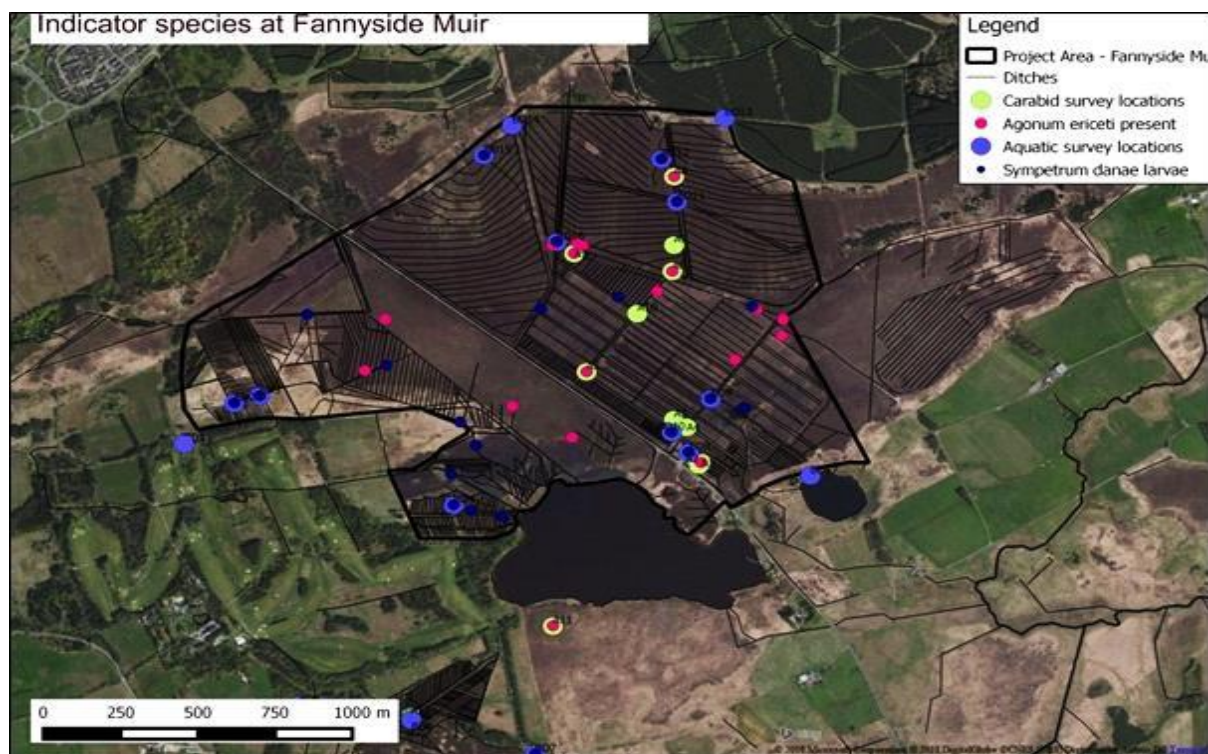
Map 5. Pre-restoration habitat condition categories at Fannyside Muir



Map 6. Post-restoration habitat condition categories at Fannyside Muir



Map 7. Expansion of suitable breeding habitat for Black darters at Fannyside Muir. Re-wetting works have increased the area of breeding habitat for Black darter dragonflies at Fannyside Muir. Approximately 7.85 ha of blocked ditches and bog pools on peat were present in 2014. Over 129.68 ha of suitable breeding habitat was present in 2018. Fannyside Loch and Easter Fannyside Loch are shown as possible breeding habitat (totalling an additional 30.45 ha), but no Black darter larvae have been recorded there.



Map 8. Distribution of peatland indicator species at Fannyside Muir. Location of 2018 sampling sites shown as large dots (blue and green). Location of all positive records of *Agonum ericeti* (pink dots) and *Sympetrum danae* larvae (dark blue dots).

Appendix ii. Photographs



Figure 1. Black darter distribution surveys at Fannyside Muir

Top Left: Black darter nymph (*Sympetrum danae*). Top Right: Shallow pools created by cell-bunding with extensive colonisation of *Sphagnum cuspidatum* and Hare's-tail cottongrass (*Eriophorum vaginatum*). Middle Left: Female Black darter (*Sympetrum danae*). Bottom Left & Bottom Right: Volunteers helping with Black darter surveys at Fannyside Muir.



Figure 2. Aquatic species recorded during Black darter surveys.

(Left to Right): Water crickets (*Velia* sp.); Black darter nymph (*Sympetrum danae*); Pond olive mayfly (*Cloeon dipterum*); Great diving beetle (*Dysticus marginalis*).



Figure 3. Monitoring at Fannyside Muir.

Top: Volunteer helping with monthly hydrology survey at Fannyside Muir in April 2018 (standing in cell-banded section of Compartment 1). Bottom Left to Right: Habitat specialist butterfly: Green hairstreak (*Callophrys rubi*); Acute-leaved bog-moss (*Sphagnum capillifolium*); Creeping willow (*Salix repens*); Habitat generalist butterfly: Peacock (*Aglais io*)



Figure 4. Fly-tipping incidents along Fannyside Road during 2018.

When dumped materials were discovered during site visits the location was noted using a GPS device and the incident reported as soon as possible. Examples include: Left: Burnt-out van and tyres (Reported April 2018 & removed August 2018). Middle: Dumped garden waste (Reported & removed July 2018). Right: Dumped commercial waste (Reported & removed July 2018).



Figure 5. Mini vegetation Quadrat photographs

Left: Dipwell 1 (August 2016) showing burnt surface and regenerating vegetation following fire in April 2016. Middle: Dipwell 1 (August 2017). Showing regeneration of heather and graminoids. Right: Dipwell 1 (June 2018). Showing regeneration of heather, graminoids and bryophytes following fire in April 2016.

		Rainfall (cm)	0	6.55	1.52	2.53	2.14	6.92	13.05	11.25	11.83	5.57	5.56	2.34	4.67	4.67	13.41	4.01	5.18	2.87	0.86	2.34	7.8	3.25	0.94	16.1	7.39	12.14	12.17	5.92	
		Reading No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
		Date	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	
STATION	Grid Ref	Elevation		Phase 1	Phase 1						Phase 2	Phase 2	Phase 2			Phase 3	Phase 3													Heath cutting	
1	NS8030073771	171	28.0	36.5	40.5	44.0	21.0	10.5	11.5	26.5	31.0	26.0	28.5	27.5	11.0	9.5	3.5	17.5	10.0	15.5	8.5	10.0	16.0	25.0	37.5	22.0	25.5	5.5	7.5	3.5	
2	NS8025873853	172	8.5	18.0	22.0	15.5	4.5	3.5	5.5	6.0	9.0	4.0	4.0	14.5	4.0	3.0	0.0	14.0	5.0	2.5	3.5	4.0	7.0	16.0	27.5	13.0	17.0	3.0	10.0	4.5	
3	NS8024073868	173	15.0	16.5	20.0	12.0	2.5	3.0	4.0	8.0	7.5	4.0	5.5	7.0	2.0	1.0	3.5	9.0	2.5	2.0	0.0	2.0	6.5	8.5	14.5	9.0	8.0	0.5	3.0	1.0	
4	NS8040174093	174	9.0	15.5	22.5	9.5	1.0	0.0	-0.5	3.0	7.5	2.0	3.5	6.0	0.0	1.0	5.5	2.0	2.5	1.0	2.5	3.0	10.0	25.0	7.0	10.0	0.5	5.0	1.5		
5	NS8038174089	174	3.0	1.5	5.0	2.0	-1.5	-2.0	-2.0	-1.0	0.0	-2.0	-2.0	1.0	-2.0	-1.5	-3.0	-1.0	-2.0	-1.0	-1.0	-2.0	-1.5	1.0	13.5	0.5	2.5	-2.0	-2.0	-2.0	
6	NS8055474278	175	12.0	15.0	21.5	17.0	1.0	-1.0	2.0	4.5	8.0	2.0	4.0	8.0	0.0	7.0	9.0	11.0	7.0	7.5	5.0	6.0	6.0	10.0	17.0	8.0	9.0	5.0	4.5	4.0	
7	NS8053474295	174	10.0	9.5	14.0	10.0	5.0	2.5	5.0	7.0	8.0	6.5	7.0	9.0	6.0	5.5	4.0	7.5	6.0	5.0	5.5	5.5	6.5	9.5	25.5	9.0	11.0	5.0	6.0	5.0	
8	NS5056074270	174	19.5	32.0	41.5	46.0	8.0	5.5	6.5	21.0	28.0	19.0	20.0	28.5	18.0	24.5	15.0	28.0	15.0	27.5	9.0	12.0	23.5	29.5	41.0	28.0	29.0	13.0	14.0	14.5	
9	NS8056574246	174	6.5	13.0	17.0	14.0	2.5	1.5	2.0	4.0	8.5	4.0	4.5	6.5	3.0	2.5	1.0	8.0	3.0	4.0	3.0	3.0	5.0	11.0	18.0	7.5	12.0	1.5	3.0	2.5	
10	NS8021074448	174	18.5	27.0	36.0	37.0	11.0	9.0	9.0	10.0	12.0	10.0	10.5	13.0	9.0	11.5	9.0	13.5	7.5	10.0	8.0	9.0	10.0	12.5	28.5	14.0	16.0	7.5	10.0	9.0	
11	NS802674469	174	6.0	14.0	21.0	24.5	4.0	3.0	4.5	5.5	8.5	5.0	5.5	6.0	5.0	7.0	6.0	8.0	5.0	6.0	6.0	5.5	6.0	10.0	25.5	8.0	8.5	4.0	5.5	4.0	
12	NS802674446	174	5.5	11.0	21.0	12.0	5.0	4.0	5.0	4.5	7.5	5.5	6.0	8.5	5.0	5.0	3.0	8.5	5.0	5.5	5.0	5.0	6.0	11.0	20.5	10.0	11.5	5.5	6.5	4.0	
13	NS8019074427	174	4.5	9.0	11.5	10.0	4.0	2.5	3.5	4.0	5.5	4.5	4.0	7.5	4.0	3.0	1.5	5.0	4.5	3.5	3.0	3.5	4.5	9.0	14.0	7.5	8.5	3.0	4.0	3.0	
14	NS8011474337	175	8.5	9.5	19.0	9.5	6.5	5.0	6.0	7.5	10.0	7.5	7.0	9.0	5.5	6.0	4.5	8.5	5.5	5.5	6.0	6.0	6.5	12.0	20.0	11.0	13.5	6.0	5.5	5.0	
15	NS7989374508	172	3.0	10.0	13.0	3.0	-1.5	-3.0	-4.0	-3.0	-3.0	-4.0	-2.5	-0.5	-4.0	-2.0	-3.0	-3.0	-3.5	-2.5	-3.5	-3.0	-3.0	-2.0	7.5	-2.0	-2.0	-4.0	-4.0	-4.0	
16	NS7990974526	172	11.0	7.0	9.0	4.0	3.5	3.0	4.0	4.5	6.5	4.5	5.0	5.5	4.0	3.5	2.5	6.0	4.0	4.0	5.0	5.0	5.5	8.5	19.0	7.0	8.0	4.0	4.5	-4.0	
17	NS7985474547	172	6.0	7.0	14.0	14.0	3.5	2.0	3.5	6.5	5.5	4.0	4.0	2.0	0.0	2.0	-0.5	3.0	1.0	2.0	0.5	1.0	2.0	10.0	2.0	3.0	1.0	1.0	-4.0	-4.0	
18	NS7983074547	172	7.0	9.0	12.5	10.5	3.5	3.0	4.0	6.0	7.5	4.0	5.0	7.0	4.5	3.0	2.0	6.0	3.5	3.5	4.0	5.0	6.0	9.5	13.5	9.0	10.0	4.0	6.5	4.0	
19	NS7986574609	171	5.5	10.0	14.0	3.0	1.5	1.0	-0.5	2.5	4.0	2.0	2.5	4.0	1.5	-0.5	-0.5	3.5	1.0	0.5	1.0	0.5	1.5	5.5	11.5	5.0	5.0	-1.0	0.5	-0.5	
20	NS7988874605	171	4.5	8.0	9.5	4.5	0.0	0.5	-1.0	4.5	6.5	4.5	5.0	6.5	4.0	4.0	2.5	6.5	4.5	4.0	5.0	4.5	5.5	10.0	18.0	10.0	12.0	4.5	5.0	4.0	
21	NS7972874220	176	22.5	19.5	25.0	23.5	11.0	7.5	10.5	11.5	12.0	11.0	11.5	13.5	11.0	11.0	7.0	13.0	11.0	10.0	10.0	10.5	11.0	12.5	17.0	11.5	12.5	8.5	10.0	8.5	
22	NS7993174138	175	4.0	12.5	21.5	8.5	0.5	0.0	0.5	2.5	5.0	2.0	2.0	7.5	2.5	2.5	2.0	6.0	2.5	2.5	1.5	1.5	3.0	10.5	27.5	10.0	10.5	1.5	3.0	1.5	
23	NS7993274114	175	24.0	34.5	32.0	36.0	-3.5	-3.0	-9.0	-8.0	-6.0	-5.0	-5.0	-3.0	-3.0	-5.0	-7.0	-4.0	-5.0	-5.0	-6.0	-5.0	-5.0	-1.0	5.0	-1.0	0.5	-5.0	-4.0	-4.0	
24	NS7989173872	172	2.0	3.0	16.0	6.0	1.0	-1.0	0.0	1.0	0.0	1.0	1.0	2.0	3.0	0.0	-1.0	2.0	0.0	1.0	1.0	0.5	1.0	4.0	19.5	2.5	4.0	0.0	1.0	0.5	
25	NS7984673804	171	12.5	18.5	20.0	12.0	10.0	10.5	10.0	11.5	15.0	12.0	11.5	16.0	10.0	10.0	9.5	15.0	10.0	10.5	10.0	11.0	13.0	22.0	23.0	16.5	20.0	11.0	11.0	10.0	
26	NS7983273782	171	11.5	21.0	26.0	21.0	9.0	8.0	7.0	11.0	15.5	9.5	10.0	10.5	7.5	9.5	5.5	13.5	9.5	11.0	9.5	10.0	10.0	14.5	21.0	14.5	19.0	9.0	11.5	10.0	
27	NS7982973780	171	6.0	15.0	23.0	17.0	0.5	0.0	-1.5	2.0	4.0	2.0	1.0	4.0	-2.0	1.0	-1.0	4.0	0.0	1.0	0.0	0.0	1.0	7.0	17.5	4.5	12.0	-1.0	1.0	1.0	
28	NS7981673758	170	16.0	15.5	17.0	4.5	1.0	1.5	0.0	2.5	5.0	3.5	3.5	6.0	2.0	2.0	1.0	8.5	2.0	2.0	2.5	1.5	7.0	13.0	27.5	10.0	13.5	1.0	5.0	2.0	
29	NS7965773596	169	12.5	21.0	29.5	26.0	15.0	17.0	14.5	16.5	21.0	15.5	16.5	20.0	9.0	6.0	-10.0	-11.0	-14.0	-14.0	-14.0	-15.0	-15.0	-13.5	-2.0	-12.0	-11.0	-15.0	-13.0	-15.0	
30	NS7965773572	168	18.5	26.0	36.0	31.0	12.5	14.5	9.0	16.0	20.0	20.0	18.0	19.0	7.0	0.0	-3.0	-8.0	-8.0	-8.0	-8.0	-8.0	-7.0	-6.0	4.0	-5.0	-2.0	-7.0	-5.0	-8.0	
31	NS7920074474	169	10.0	20.0	30.5	36.0	-2.5	-2.0	-4.0	-1.0	0.5	-2.5	-2.5	0.0	2.5	-3.0	-3.0	-1.0	-3.0	-1.5	-2.0	-2.0	-1.0	5.0	14.0	2.0	4.0	-2.0	-2.5	-2.5	
32	NS7918074468	169	15.5	17.0	24.0	20.0	8.0	9.0	6.5	12.0	14.0	13.0	18.0	14.0	14.0	17.5	16.0	14.0	13.0	13.5	10.0	9.0	12.5	14.5	24.0	13.5	15.0	13.5	11.0	10.0	
				Phase 1	Phase 1							Phase 2	Phase 2	Phase 2			Phase 3	Phase 3												Heath cutting	
		Average	10.8	15.7	21.4	17.0	4.6	3.6	3.5	6.5	8.9	6.1	6.6	8.9	4.2	4.2	2.4	6.8	3.3	4.08	2.78	3.09	4.75	9.09	18.8	7.89	9.88	2.53	2.53	2.16	
		% within 10cm	56.3	34.4	9.4	40.6	84.4	87.5	90.6	75	71.8	78.1	75	65.6	87.5	87.5	93.8	71.9	90.6	84.4	100	87.5	84.4	65.6	15.6	78.1	50	93.7	93.7	96.8	

Appendix iii Table 4 (Part I). Monthly Hydrology data. Blue & green indicates area suitable for *Sphagnum*. Orange & red indicate unsuitable areas.

		Rainfall (cm)	5.92	8.43	10.69	10.11	6.48	8.68	4.34	4.65	2.34	7.04	
		Reading No.	29	30	31	32	33	34	35	36	37	38	
		Date	Nov-17	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	
STATION	Grid Ref	Elevation											
1	NS8030073771	171	3.0	-0.5	10.0	3.5	8.0	1.5	15.5	27.0	40.5	34.5	Control
2	NS8025873853	172	2.5	5.5	6.0	2.0	3.5	1.5	10.0	14.0	30.0	24.0	
3	NS8024073868	173	1.0	0.0	4.5	-1.0	-1.0	-1.0	8.0	6.0	20.0	12.5	
4	NS8040174093	174	1.0	2.5	2.5	1.0	2.5	1.0	5.5	6.0	28.0	10.5	
5	NS8038174089	174	-2.0	-2.0	-1.5	-2.0	-1.0	-2.0	-0.5	0.0	19.0	-2.0	
6	NS8055474278	175	2.0	0.0	5.0	0.0	1.0	-1.0	5.0	3.0	11.5	6.0	
7	NS8053474295	174	5.0	5.5	6.5	5.0	6.0	4.5	7.0	7.0	30.0	8.5	
8	NS5056074270	174	18.0	9.0	20.0	6.0	12.0	7.5	29.0	27.5	40.5	36.5	Control
9	NS8056574246	174	2.5	3.5	5.5	3.0	5.5	2.0	5.0	4.5	21.5	10.5	
10	NS8021074448	174	8.5	8.0	10.0	6.5	7.0	6.5	12.0	12.5	28.0	26.0	
11	NS8022674469	174	4.0	5.5	7.0	4.5	5.5	2.0	13.0	11.0	26.0	15.0	
12	NS8020674446	174	5.0	5.0	5.5	5.0	6.0	5.0	5.0	6.5	26.5	16.0	Above ground
13	NS8019074427	174	2.5	4.0	4.0	3.5	4.5	2.5	4.5	6.0	19.0	12.5	0 - 10.0
14	NS8011474337	175	4.5	5.5	6.5	6.0	8.0	5.0	8.0	9.0	21.0	14.5	10.5 - 20.0
15	NS7989374508	172	-4.0	-7.5	-6.0	-4.0	-5.5	-5.0	-2.5	-2.0	22.0	0.0	20.5 - 30.0
16	NS7990974526	172	-4.0	-4.0	-2.0	-3.0	-2.5	-5.0	1.0	2.5	21.0	3.0	30.5+
17	NS7985474547	172	-7.0	-7.0	-7.0	-7.0	-6.0	-10.0	-2.0	-2.0	14.0	-3.5	
18	NS7983074547	172	3.5	3.0	5.0	3.5	4.0	3.0	6.0	6.5	14.5	8.0	
19	NS7986574609	171	-0.5	-1.5	0.5	-1.0	0.5	-1.0	-0.5	3.0	16.0	8.5	
20	NS7988874605	171	2.5	3.0	4.0	3.0	4.5	2.5	4.5	8.0	20.0	19.0	
21	NS7972874220	176	8.0	8.0	10.0	7.0	9.0	5.5	10.0	14.5	26.4	24.0	
22	NS7993174138	175	-1.0	1.0	6.0	1.0	3.0	1.0	10.0	8.5	32.0	9.0	
23	NS7993274114	175	-4.0	-6.0	-5.0	-6.0	-3.0	-5.0	-1.0	-1.5	12.5	1.5	
24	NS7989173872	172	0.0	1.0	1.0	-1.0	0.0	-1.0	2.0	1.0	22.0	6.0	
25	NS7984673804	171	10.0	9.0	12.0	9.5	11.0	9.5	17.5	19.0	27.0	22.5	
26	NS7983273782	171	8.5	7.5	10.0	8.0	9.5	6.0	16.5	14.5	33.5	33.5	
27	NS7982973780	171	0.0	0.0	1.0	0.0	-1.0	-2.0	4.5	2.5	29.0	9.5	
28	NS7981673758	170	2.5	2.0	4.0	-0.5	1.0	2.5	17.5	7.5	35.0	31.0	
29	NS7965773596	169	-15.0	-15.0	-15.0	-15.0	-15.0	-15.0	-10.0	-8.0	2.5	-4.0	
30	NS7965773572	168	-8.0	-8.0	-8.5	-8.0	-6.0	-7.0	-4.0	-5.0	11.5	0.5	
31	NS7920074474	169	-3.0	-3.0	-5.0	-5.0	-5.0	-5.0	0.0	-2.0	21.0	13.0	
32	NS7918074468	169	13.0	13.0	11.0	9.0	10.0	8.0	15.5	18.5	34.0	27.0	Control
		Average	1.8	1.47	3.4	1.0	2.4	0.53	6.62	7.04	23.6	13.55	
		% within 10cm	93.7	96.875	93.75	100	93.75	100	75	71.875	3.125	43.75	

Appendix iii Table 4 (partII). Monthly Hydrology data. Blue & green indicates area suitable for *Sphagnum*. Orange & red indicate unsuitable areas.

No.	Grid Ref.	2015					2016					2017					2018					
		% Sphagnum	% True grasses	% Cotton grasses	% Calluna	Summary	% Sphagnum	% True grasses	% Cotton grasses	% Calluna	Summary	% Sphagnum	% True grasses	% Cotton grasses	% Calluna	Summary	% Sphagnum	% True grasses	% Cotton grasses	% Calluna	Summary	
1	NS8030073771	0.0	1.0	1.0	90.0	RED	0.0	1.0	0.0	2.0	RED	0.0	15.0	0.0	30.0	RED	0.0	35.0	0.0	40.0	RED	*Control
2	NS8025873853	2.0	1.0	20.0	80.0	RED	2.0	1.0	20.0	75.0	RED	7.0	1.0	5.0	75.0	RED	7.0	1.0	5.0	70.0	RED	
3	NS8024073868	0.0	90.0	1.0	5.0	RED	0.0	90.0	1.0	5.0	RED	4.0	90.0	3.0	5.0	RED	7.0	92.0	3.0	5.0	RED	
4	NS8040174093	60.0	5.0	40.0	30.0	GREEN	60.0	5.0	40.0	30.0	GREEN	65.0	10.0	40.0	35.0	GREEN	65.0	10.0	40.0	35.0	GREEN	
5	NS8038174089	30.0	0.0	80.0	10.0	GREEN	30.0	0.0	80.0	10.0	GREEN	45.0	2.0	80.0	30.0	GREEN	45.0	2.0	80.0	30.0	GREEN	
6	NS8055474278	75.0	5.0	20.0	30.0	GREEN	75.0	5.0	20.0	30.0	GREEN	80.0	20.0	30.0	20.0	GREEN	80.0	20.0	30.0	20.0	GREEN	
7	NS8053474295	90.0	15.0	5.0	40.0	GREEN	90.0	15.0	5.0	40.0	GREEN	95.0	10.0	12.0	30.0	GREEN	95.0	15.0	15.0	30.0	GREEN	
8	NS5056074270	0.0	2.0	0.0	80.0	RED	0.0	2.0	0.0	80.0	RED	0.0	5.0	5.0	80.0	RED	0.0	5.0	5.0	80.0	RED	*Control
9	NS8056574246	0.0	25.0	10.0	80.0	RED	0.0	25.0	10.0	80.0	RED	20.0	25.0	25.0	15.0	AMBER	20.0	25.0	25.0	15.0	AMBER	
10	NS8021074448	0.0	15.0	0.0	60.0	RED	0.0	15.0	0.0	60.0	RED	0.0	5.0	15.0	55.0	RED	0.0	5.0	15.0	55.0	RED	
11	NS8022674469	30.0	0.0	10.0	40.0	GREEN	30.0	0.0	10.0	40.0	GREEN	30.0	0.0	20.0	40.0	GREEN	30.0	0.0	20.0	40.0	GREEN	
12	NS8020674446	40.0	0.0	40.0	45.0	AMBER	40.0	0.0	40.0	40.0	GREEN	41.0	0.0	40.0	40.0	GREEN	41.0	0.0	40.0	40.0	GREEN	
13	NS8019074427	5.0	0.0	20.0	20.0	RED	5.0	0.0	20.0	20.0	RED	8.0	2.0	25.0	35.0	RED	8.0	2.0	25.0	35.0	RED	
14	NS8011474337	5.0	1.0	5.0	25.0	RED	5.0	1.0	5.0	25.0	RED	6.0	3.0	5.0	20.0	RED	6.0	3.0	5.0	15.0	RED	
15	NS7989374508	0.0	0.0	25.0	40.0	RED	0.0	0.0	25.0	40.0	RED	18.0	5.0	40.0	15.0	RED	18.0	5.0	40.0	15.0	RED	
16	NS7990974526	5.0	0.0	20.0	20.0	RED	5.0	0.0	20.0	20.0	RED	8.0	8.0	35.0	10.0	RED	13.0	8.0	35.0	10.0	RED	
17	NS7985474547	10.0	20.0	5.0	75.0	RED	10.0	20.0	5.0	75.0	RED	20.0	15.0	35.0	15.0	AMBER	21.0	15.0	35.0	15.0	GREEN	
18	NS7983074547	10.0	0.0	20.0	80.0	RED	10.0	0.0	20.0	80.0	RED	10.0	0.0	20.0	70.0	RED	10.0	0.0	20.0	55.0	RED	
19	NS7986574609	0.0	25.0	0.0	20.0	RED	0.0	25.0	0.0	20.0	RED	0.0	15.0	20.0	40.0	RED	0.0	25.0	20.0	40.0	RED	
20	NS7988874605	75.0	0.0	10.0	80.0	AMBER	75.0	0.0	10.0	80.0	AMBER	80.0	0.0	20.0	15.0	GREEN	80.0	0.0	20.0	15.0	GREEN	
21	NS7972874220	2.0	5.0	5.0	80.0	RED	2.0	5.0	5.0	80.0	RED	2.0	5.0	5.0	75.0	RED	2.0	5.0	5.0	75.0	RED	
22	NS7993174138	23.0	0.0	25.0	10.0	AMBER	23.0	0.0	25.0	10.0	AMBER	20.0	0.0	40.0	15.0	AMBER	20.0	0.0	40.0	15.0	AMBER	
23	NS7993274114	0.0	5.0	0.0	100.0	RED	0.0	5.0	0.0	100.0	RED	5.0	2.0	0.0	0.0	RED	5.0	2.0	0.0	0.0	RED	
24	NS7989173872	95.0	5.0	5.0	25.0	GREEN	95.0	5.0	5.0	25.0	GREEN	90.0	10.0	5.0	30.0	GREEN	90.0	10.0	5.0	30.0	GREEN	
25	NS7984673804	0.0	75.0	0.0	40.0	RED	0.0	75.0	0.0	40.0	RED	0.0	70.0	5.0	15.0	RED	0.0	70.0	5.0	15.0	RED	
26	NS7983273782	0.0	100.0	0.0	0.0	RED	0.0	100.0	0.0	0.0	RED	0.0	85.0	15.0	0.0	RED	0.0	85.0	15.0	0.0	RED	
27	NS7982973780	0.0	100.0	0.0	5.0	RED	0.0	100.0	0.0	5.0	RED	0.0	95.0	3.0	10.0	RED	0.0	95.0	5.0	10.0	RED	
28	NS7981673758	0.0	20.0	0.0	0.0	RED	0.0	20.0	0.0	0.0	RED	0.0	20.0	15.0	0.0	RED	0.0	20.0	15.0	0.0	RED	
29	NS7965773596	5.0	0.0	10.0	95.0	RED	5.0	0.0	10.0	95.0	RED	40.0	0.0	85.0	70.0	AMBER	40.0	0.0	85.0	10.0	GREEN	
30	NS7965773572	0.0	0.0	5.0	80.0	RED	0.0	0.0	5.0	80.0	RED	20.0	0.0	60.0	40.0	AMBER	25.0	0.0	60.0	30.0	GREEN	
31	NS7920074474	0.0	5.0	0.0	90.0	RED	0.0	5.0	0.0	85.0	RED	5.0	5.0	2.0	85.0	RED	5.0	5.0	5.0	80.0	RED	
32	NS7918074468	0.0	5.0	0.0	15.0	RED	0.0	5.0	0.0	15.0	RED	0.0	10.0	0.0	15.0	RED	0.0	20.0	3.0	15.0	RED	*Control
					% GREEN	15.63				% GREEN	21.875				% GREEN	28.125				% GREEN	34.375	
					% AMBER	9.375				% AMBER	6.25				% AMBER	12.5				% AMBER	6.25	
					% RED	75.00				% RED	75				% RED	59.375				% RED	59.375	

Appendix iii Table 5. Annual Vegetation Monitoring data (50 cm x 50 cm mini-quadrats). GREEN: >25 % Sphagnum, < 41% Calluna, <41 % True grasses. AMBER: >20 % Sphagnum (but possibly extensive Calluna or graminoids). RED: Under 20 % Sphagnum.

Appendix iv. 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.).

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

3.1 Flora and fungi

3.1.1 Higher Plants

Key bog indicator species

Blaeberry (*Vaccinium myrtillus*)
Bog asphodel (*Narthecium ossifragum*)
Common cottongrass (*Eriophorum angustifolium*)
Cranberry (*Vaccinium oxycoccus*)
Cross-leaved heath (*Erica tetralix*)
Crowberry (*Empetrum nigrum*)
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*)
Beech (*Fagus sylvatica*) #
Bird's foot trefoil (*Lotus corniculatus*)
Biting stonecrop (*Sedum acre*) #
Bog pond weed (*Potamogeton polyponifolius*)
Bottle sedge (*Carex rostrata*)
Bracken (*Pteridium aquilinum*)
bramble (*Rubus fruticosus*) #
Bridewort (*Spiraea* sp.) #
Broad-leaved dock (*Rumex obtusifolius*) #
Broad leaved willowherb (*Epilobium montanum*) #
Broom (*Cytisus scoparius*) #
Bush vetch (*Vicia sepium*)#
Carnation sedge (*Carex panicea*)
Chickweed wintergreen (*Trientalis europaea*)
Cleavers (*Galium aparine*)
Cock's foot grass (*Dactylis glomerus*) #
Colts foot (*Tussilago farfara*)
Common bent (*Agrostis capillaris*)
Common couch grass (*Elytrigia repens*) #
Common figwort (*Scropularia nodosa*)#
Common hemp-nettle (*Galeopsis tetrahit*) #
Common knapweed (*Centaurea nigra*)
Common orache (*Atriplex patula*) #
Common plantain (*Plantago major*) #
Common rhododendron (*Rhododendron ponticum*)
Common silverweed (*Argentina anserine*) #

Common sorrel (*Rumex acetosa*) #
Common spotted orchid (*Dactylorhiza fuchsia*)
Common twayblade (*Listera ovata*)
Common valerian (*Valeriana officinalis*) #
Common vetch (*Vicia sativa*)
Compact rush (*Juncus conglomeratus*)
Cow parsley (*Anthriscus sylvestris*) #
Creeping buttercup (*Ranunculus repens*)
Creeping forget-me-not (*Myositis secunda*) #
Creeping thistle (*Cirsium vulgare*) #
Creeping willow (*Salix repens*)
Crocus (*Crocus vernus*) #
Cuckoo flower (*Cardamine pratensis*) #
Daisy (*Bellis perennis*) #
Dame's violet (*Hesperis matronalis*) #
daffodil (*Narcissus* sp.)
dandelion (*Taraxacum* sp.)
Devil's bit scabious (*Succisa pratensis*)
Downy birch (*Betula pubescens*)
Eared willow (*Salix aurita*)
Early marsh orchid (*Dactylorhiza incarnata*)
eyebright (*Euphrasia* sp.)
Field horsetail (*Equisetum arvense*) #
Field wood-rush (*Luzula campestris*)
Fox and cubs (*Pilosella aurantiaca*)
Garden strawberry (*Fragaria x ananassa*) #
Glaucous sedge (*Carex flacca*)
Goat willow (*Salix caprea*)
Gorse (*Ulex europeaus*)
Great willowherb (*Epilobium hirsutum*)
Greater birds-foot trefoil (*Lotus pendunculatus*)
Greater butterfly orchid (*Platanthera chlorantha*)
Grey willow (*Salix cinerea*)
Ground elder (*Aegopodium podagraria*) #
Hard fern (*Blechnum spicant*)
Hawkweeds (*Hieracium* sp.) #
Hawthorn (*Crataegus monogyna*)
Heath bedstraw (*Galium saxatile*)
Heath milkwort (*Polygala serpyllifolia*)
Heath rush (*Juncus squarrosus*)
Heath spotted orchid (*Dactylorhiza maculata*)
Heath wood-rush (*Luzula multiflora*)
Hop trefoil (*Trifolium campestre*) #
Japanese knotweed (*Fallopia japonica*) #
Japanese rose (*Rosa rugosa*) #
Kidney vetch (*Anthyllis vulneraria*) #
Knotgrass (*Polygonum aviculare*) #
Lesser stitchwort (*Stellaria graminea*)
Lodgepole pine (*Pinus contorta*)
Lousewort (*Pedicularis sylvatica*)
Lungwort (*Pulmonaria officinalis*) #
Marsh arrow-grass (*Triglochin palustris*) #

Marsh cinquefoil (*Potentilla palustris*)
 Marsh lousewort (*Pedicularis palustris*)
 Marsh thistle (*Cirsium palustre*)
 Marsh violet (*Viola palustris*)
 Marsh willowherb (*Epilobium palustre*)
 Meadow vetchling (*Lathyrus pratensis*)
 Michaelmas daisy (*Aster x salignus*) #
 Montbretia (*Crocasmia x crocosmiiflora*) #
 Narrow buckler fern (*Dryopteris carthusiana*)
 Nipplewort (*Lapsana communis*) #
 Northern marsh orchid (*Dactylorhiza purpurella*)
 Pignut (*Conopodium majus*)
 Pineapple weed (*Matricaria discoidea*)
 Purple moor grass (*Molinia caerulea*)
 Ragwort (*Senecio jacobaea*) #
 Raspberry (*Rubus idaeus*) #
 Red bartsia (*Odontites vernus*) #
 Red clover (*Trifolium pratense*) #
 Red fescue (*Festuca rubra*) #
 Redshank (*Persicaria maculosa*) #
 Reed mace (*Typha latifolia*)
 Rhododendron (*Rhododendron ponticum*)
 Ribwort plantain (*Plantago lanceolata*)
 Rosebay willowherb (*Epilobium angustifolium*) #
 Round-fruited rush (*Juncus compressus*)
 Round-leaved plantain (*Plantago major*)
 Rowan (*Sorbus aucuparia*)
 rushes (*Juncus sp.*)
 Scots pine (*Pinus sylvestris*)
 Selfheal (*Prunella vulgaris*)
 Sharp-flowered rush (*Juncus acutiflora*)
 Sheeps sorrel (*Rumex acetosella*)\$
 Short-fruited willowherb (*Epilobium obscura*) #
 Silver birch (*Betula pendulus*)
 Sitka spruce (*Picea sitchensis*)
 Smooth sow-thistle (*Sonchus oleraceus*) #
 Sneezewort (*Achillea ptarmica*)
 snowdrop (*Galanthus sp.*)
 Soft rush (*Juncus effusus*)
 Spear thistle (*Cirsium arvense*) #
 Stinging nettle (*Urtica dioica*) #
 St. John's wort (*Hypericum sp.*)
 Sweet vernal grass (*Anthoxanthum odoratum*)
 Tormentil (*Potentilla erecta*)
 Tufted hair grass (*Deschampsia cespitosa*)
 Wavy bittercress (*Cardamine flexuosa*) #
 Wavy hair grass (*Deschampsia flexuosa*)
 White clover (*Trifolium repens*) #
 Wild strawberry (*Fragaria vesca*)
 Yarrow (*Achillea millefolium*)
 Yellow flag iris (*Iris pseudacorus*)
 Yellow loosestrife (*Lysimachia vulgaris*) #

Yellow rattle (*Rhinanthus minor*) #
Yorkshire fog (*Holcus lanatus*)

3.1.2 Bryophytes, fungi, lichens and club-mosses

Bryophytes (including key bog indicator species)

Acute-leaved bog-moss (*Sphagnum capillifolium*)
Blunt-leaved bog-moss (*Sphagnum palustre*)
Bog bead moss (*Aulacomnium palustre*)
Bogmoss flapwort (*Odontoshisma sphagnii*)
Common haircap moss (*Polytrichum commune*)
Feathery bog-moss (*Sphagnum cuspidatum*)
Fir clubmoss (*Huperzia selago*)
Flat-topped bog-moss (*Sphagnum fallax*)
Heath plait moss (*Hypnum jutlandicum*)
Heath star moss (*Campylopus introflexus*)
Lustrus bog-moss (*Sphagnum subnitens*)
Magellanic bog-moss (*Sphagnum magellanicum*)
Notched pouchwort (*Calypogeia arguta*)
Papillose bog-moss (*Sphagnum papillosum*)
Soft bog-moss (*Sphagnum tenellum*)
Strict haircap moss (*Polytrichum strictum*)
Springy turf-moss (*Rhytidiadelphus squarrosus*)
Waved silk-moss (*Plagiothecium undulatum*)
Broom fork-moss (*Dicranium scoparium*)

Lichens

lichen *Cladonia chlorophaea* agg.
lichen *Cladonia coniocraea*
lichen *Cladonia floerkeana*
lichen *Cladonia portentosa*
lichen *Evernia prunastri*
lichen *Peltigera membranacea*

Fungi

Alder tongue gall (*Taphrina alni*)
Beefsteak fungus (*Fistulina hepatica*)\$
Common earthball (*Scleroderma citrinum*)
Honey fungus (*Armillaria* sp.)
Jelly ear fungus (*Auricularia aricula-judae*)
Rosy crust (*Peniophora incarnata*) – on gorse
Sickner (*Russula emetica*)
Waxcaps (*Hygrocybe* sp.)
Yellow brain (*Tremella mesenterica*) – on gorse
Yellow staghorn fungus (*Calocera viscosa*)

Slimemoulds

Dog sick slimemould (*Fuligo septica*)
Bubblemould fungus (*Lycogala epidendrum*)

3.2 Birds

Barn owl (*Tyto alba*)
Barn swallow (*Hirundo rustica*)

Blackbird (*Turdus merula*)
 Black-headed gull (*Chroicocephalus ridibundus*)
 Blue tit (*Cyanistes caeruleus*)
 Bullfinch (*Pyrrhula pyrrhula*)
 Buzzard (*Buteo buteo*)
 Canada goose (*Branta canadensis*)
 Carrion crow (*Corvus corone*)
 Chaffinch (*Fringilla coelebs*)
 Coal tit (*Periparus ater*)
 Coot (*Fulica atra*)
 Common crossbill (*Loxia curvirostra*)
 Common gull (*Larus canus*)
 Common sandpiper (*Actitis hypoleucos*)
 Cuckoo (*Cuculus canorus*)
 Curlew (*Numenius arquata*)
 Dunlin (*Calidris alpina*)
 Feral pigeon (*Columba livia*)
 Fieldfare (*Turdus pilaris*)
 Garden warbler (*Sylvia borin*)
 Goldcrest (*Regulus regulus*)
 Goldeneye (*Bucephala clangula*)
 Goldfinch (*Carduelis carduelis*)
 Gooseander (*Mergus merganser*) * Recorded at RSPB Fannyside
 Grasshopper warbler (*Locustella naevia*)
 Greater spotted woodpecker (*Dendrocopos major*)
 Great black-backed gull (*Larus marinus*)
 Great grey shrike (*Lanius excubitor*)
 Great tit (*Parus major*)
 Greylag goose (*Anser anser*)
 Grey Heron (*Ardea cinerea*)
 Grey partridge (*Perdix perdix*) * Recorded at RSPB Fannyside
 Hen harrier (*Circus cyaneus*)
 Herring gull (*Larus argentatus*)
 House Martin (*Delichon urbicum*)
 Jackdaw (*Corvus monedula*)
 Jay (*Garrulus glandarius*)
 Jack snipe (*Lymnocyptes minimus*)
 Kestrel (*Falco tinnunculus*)
 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*)
 Oystercatcher (*Haematopus ostralegus*)
 Raven (*Corvus corax*) – flying overhead

Redshank (*Tringa tetanus*)
 Peregrine (*Falco peregrinus*)
 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*)
 Short-eared owl (*Asio flammeus*)
 Siskin (*Spinus spinus*)
 Skylark (*Alauda arvensis*)
 Snipe (*Gallinago gallinago*)
 Songthrush (*Turdus philomelos*)
 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*)
 Teal (*Anas crecca*)
 Tufted duck (*Aythya fuligula*)
 Water rail (*Rallus aquaticus*)
 White-fronted goose (*Anser albifrons*)
 Wigeon (*Anas penelope*)
 Willow warbler (*Phylloscopus trochilus*)
 Wheatear (*Oenanthe oenanthe*)
 Whinchat (*Saxicola rubetra*)
 Whitethroat (*Sylvia communis*)
 Woodcock (*Scolopax rusticola*)
 Wood pigeon (*Columba palumbus*)
 Wren (*Troglodytes troglodytes*)
 Yellowhammer (*Emberiza citronella*)

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*)
 Common shrew (*Sorex araneus*) #
 European hedgehog (*Erinaceus europeus*)
 European mole (*Talpa europea*)
 European otter (*Lutra lutra*) – scat
 Field vole (*Microtus agrestis*)
 Grey squirrel (*Sciurus carolinensis*)
 Pine martin (*Martes martes*) * Recorded at Palacerigg Country Park
 Red fox (*Vulpes vulpes*) –scat & footprints
 Roe deer (*Capreolus capreolus*)

Stoat (*Mustela erminea*)

Water vole (*Arvicola amphibious*) * Recorded at Palacerigg Country Park

Weasel (*Mustela nivalis*) #

3.4 Invertebrates

Acari (mites)

Birch gall mite (*Acalitus rudis*)

Alder gall mite (*Eriophyes inangulis*)

Annelids (earth worms)

Red worm (*Lumbricus rubellus*) # Dumped vegetation

Araneae (spiders)

Common crab spider (*Xysticus cristatus*)

comb-footed spider *Enoplognatha ovata* agg.

comb-footed spider *Theridion sisyphium*

Cucumber spider (*Araniella cucurbitina*)

Four-spot orb weaver (*Araneus quadratus*)

Furrowed orb-weaver (*Larinioides cornutus*)

Garden orb weaver (*Araneus diadematus*)

Grass blade spider (*Tibellus oblongus*)

jumping spider *Neon reticulatus*

Lace-webbed spider (*Amaurobius similis*) #

long-jawed spider *Metellina mengei*

long-jawed spider *Metellina segmentata*

long-jawed spider *Tetragnatha extensa*

long-jawed spider *Tetragnatha montana*

money spider *Bathyphantes setiger*

money spider *Bolyphantes luteolus*

money spider *Centromerita concinna*

money spider *Ceratinella brevipipes*

money spider *Cnephalocotes obscurus*

money spider *Floronia bucculenta*

money spider *Gonatium rubens*

money spider *Linyphia triangularis*

money spider *Maso sundevalli*

money spider *Meioneta saxatilis sensu stricto*

money spider *Micrargus herbigradus sensu stricto*

money spider *Neriene* sp.

money spider *Paidiscura pallens*

money spider *Pelecopsis parallela*

money spider *Peponocranium ludicrum*

money spider *Pocadicnemis pumila sensu stricto*

money spider *Saaristoa firma*

money spider *Tenuiphantes cristatus*

money spider *Tenuiphantes mengei*

money spider *Tenuiphantes tenuis*

money spider *Tenuiphantes zimmermanni*

money spider *Walckenaeria acuminata*

money spider *Walckenaeria antica*

money spider *Walckenaeria unicornis*

mesh-web spider *Dictyna* sp

mesh-web spider *Dictyna arundinacea*
orb-weaver spider *Hypsosinga pygmaea*
sac spider *Cheiracanthium erraticum*
sac spider *Clubiona trivialis*
wolf spider *Pardosa sp.*
wolf spider *Pardosa amentata*
wolf spider *Pardosa nigriceps*
wolf spider *Pardosa palustris*
wolf spider *Pirata piraticus*
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 linearis*
diving beetle *Agabus bipustulatus*
diving beetle *Agabus sturmii*
diving beetle *Dytiscus sp.*
diving beetle *Dytiscus marginalis*
diving beetle *Hydroporus gyllenhalii*
diving beetle *Hydroporus erythrocephalus*
diving beetle *Hydroporus incognitus*
diving beetle *Hydroporus morio*
diving beetle *Hydroporus obscurus*
diving beetle *Hydroporus palustris*
diving beetle *Hydroporus pubescens*
diving beetle *Hydroporus tristis*
diving beetle *Rhantus suturellus*
diving beetle *Stictonectes lepidus*
flower beetle *Oedemera virescens*
ground beetle *Agonum ericeti*
ground beetle *Agonum fuliginosum*
ground beetle *Bembidion bruxellense*
ground beetle *Bembidion stepheni*
ground beetle *Calodromius spilotus*
ground beetle *Carabus problematicus*
ground beetle *Dromius quadrimaculatus*
ground beetle *Elaphrus cupreus*
ground beetle *Loricera pilicornis*
ground beetle *Nebria brevicollis*
ground beetle *Paranchus albipes*
ground beetle *Pterostichus adstrictus*
ground beetle *Pterostichus diligens*
ground beetle *Pterostichus madidus*
ground beetle *Pterostichus niger*
ground beetle *Pterostichus rhaeticus*
Heather beetle (*Lochmaea suturalis*)
Hieroglyphic ladybird (*Coccinella hieroglyphica*)
Larch ladybird (*Aphidecta oblitterata*)

leaf beetle *Altica palustris*
 leaf beetle *Phaedon armoraciae*
 leaf beetle *Phyllotreta flexuosa*
 leaf beetle *Plagioderma versicolora*
 leaf beetle *Neocrepidodera transversa*
 leaf beetle *Galeruca tanacetii*
 Orange ladybird (*Halyzia sedecimguttata*)
 Raspberry beetle (*Byturus tomentosus*)
 Red-breasted carrion beetle (*Oiceoptoma thoracica*)
 Red soldier beetle (*Rhagonycha fulva*)
 reed beetle *Plateumaris discolor*
 rove beetle *Anthrophagus caraboides*
 rove beetle *Platydacus stercorarius*
 rove beetle *Quedius fuliginosus*
 rove beetle *Quedius* sp.
 rove beetle *Staphylinus erythropterus*
 rove beetle *Stenus brunnipes*
 rove beetle *Stenus lustrator*
 rove beetle *Stenus nitens*
 rove beetle *Stenus pubescens*
 rove beetle *Stenus similis*
 Seven-spot ladybird (*Coccinella 7-punctata*)
 sexton beetle *Nicrophorus humator*
 sexton beetle *Nicrophorus vespilloides*
 soldier beetle *Cantharis nigricans*
 soldier beetle *Cantharis pellucida*
 soldier beetle *Rhagonycha limbata*
 Ten-spot ladybird (*Adalia 10-punctata*)
 thick-legged flower beetle *Oedemera virescens*
 Two-banded longhorn (*Rhagium bifasciatum*)
 tumbling flower beetle *Anaspis thoracica*
 water scavenger beetle *Anacaena lutescens*
 water scavenger beetle *Anacaena globulus*
 water scavenger beetle *Helophorus flavipes*
 water scavenger beetle *Hydrobius fuscipes*
 weevil *Exapion ulicis*
 weevil *Limnobaris dolorosa*
 weevil *Micrelus ericae*
 weevil *Otiorhynchus singularis*
 weevil *Orchestes rusci*
 weevil *Phyllobius pyri*
 weevil *Polydrusus cervinus*
 weevil *Strophosoma melanogrammum*
 whirligig beetle *Gyrinus substriatus*
 whirligig beetle *Gyrinus caspius*
 Willow leaf beetle (*Lochmaea caprea*)

Collembola (spring tails)

globular springtail *Dicyrtoma fusca*
 globular springtail *Dicyrtomina minuta*
 globular springtail *Dicyrtomina saundersi*
 globular springtail *Sminthurus viridis*

Dermiptera (earwings)

Common earwig (*Forficula auricularia*)

Diptera (flies)

biting midge *Culicoides* sp.
mosquito *Culiseta* sp
mosquito *Culicidae* - larvae
blowfly *Calliphora* sp.
blowfly *Lucilia* sp.
cleg *Haematopota pluvialis*)
conopid fly *Conops quadrifasciatus*
conopid fly *Sicus ferrugineus*
cluster fly *Pollenia* sp.
cranefly *Dolichopeza albipes*
cranefly *Idioptera pulchella*
cranefly *Limonia mitis*
cranefly *Pedicia rivosa*
cranefly *Phalacrocerera replicata*
cranefly *Tipula luna*
cranefly *Tipula maxima*
cranefly *Tipula paludosa*
cranefly *Tipula subnodicornis*
cranefly *Ula mollissima*
dancefly *Empis tessellata*
dancefly *Hybos culicormis*
Dark giant horsefly (*Tabanus sudeticus*)
Deer ked (*Lipoptena cervi*)
Down-looker snipefly (*Rhagio scolopaceus*)
fungus gnat (*Bolitophila saundersii*)
gall midge *Iteomyia capreae*
Holly leaf miner (*Phytomyza ilicus*)
hoverfly *Cheilosia bergenstammi*
hoverfly *Cheilosia grossa*
hoverfly *Cheilosia pagana*
hoverfly *Chrysotoxum arcuatum*
hoverfly *Dasysyrphus venustus*
hoverfly *Didea fasciata*
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 corollae*
hoverfly *Eupeodes luniger*
hoverfly *Helophilus hybridus*
hoverfly *Helophilus pendulus*
hoverfly *Helophilus trivittatus*
hoverfly *Leucozonia glaucia*
hoverfly *Leucozonia lucorum*

hoverfly *Meliscaeva cinctella*
 hoverfly *Melanostoma scalare*
 hoverfly *Melanostoma mellinum*
 hoverfly *Melangyna lasiophthalma*
 hoverfly *Myathropa florea*
 hoverfly *Neoascia podagrica*
 hoverfly *Neoascia tenur*
 hoverfly *Pipizella viduata*
 hoverfly *Parasyrphus punctulatus*
 hoverfly *Platycheirus albimanus*
 hoverfly *Platycheirus clypeatus*
 hoverfly *Platycheirus granditarsus*
 hoverfly *Platycheirus occultus*
 hoverfly *Platycheirus ramsarensis*
 hoverfly *Platycheirus rosarum*
 hoverfly *Rhingia campestris*
 hoverfly *Scaeva pyrastris*
 hoverfly *Sericomyia lappona*
 hoverfly *Sericomyia silentis*
 hoverfly *Sphaerophoria* sp.
 hoverfly *Syrphus ribesii*
 hoverfly *Syrphus vitripennis*
 hoverfly *Syrphus torvus*
 hoverfly *Syrpitta pipiens*
 hoverfly *Volucella bombylans*
 hoverfly *Volucella pellucens*
 hoverfly *Xylota segnis*
 marsh fly *Pherbellia albocostata*
 mothflies *Psychodidae*
 Noon fly (*Mesembrina meridiana*)
 picture-wing fly *Campiglossa argyrocephala*
 picture-wing fly *Tephritis conura*
 picture-wing fly *Tephritis neesii*
 picture-wing fly *Xyphosia miliaria*
 pipunculid fly *Verrallia aucta*
 Red-legged St Marks fly (*Bibio pomonae*)
 soldierfly *Beris chalybata*
 soldierfly *Beris vallata*
 St Mark's fly (*Bibio marci*)
 tachinid fly *Gymnochaeta viridis*
 tachinid fly *Tachina fera*
 tachinid fly *Tachina grossa*
 tachinid fly *Tachina ursina*
 winter gnats *Trichoceridae*
 Yellow dung fly (*Scathophaga stercoraria*)

Ephemeroptera (mayflies)

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

Hemiptera (true bugs)

Alder spittlebug (*Aphrophora alni*)

back swimmer *Notonecta* sp.
 Birch shieldbug (*Elasmostethus interstinctus*)
 flower bug *Anthocoris* sp.
 Common froghopper (*Philaenus spumarius*)
 Gorse shieldbug (*Piezodorus 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 *Capsus 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*
 Parent bug (*Elasmucha grisea*)
 plant hopper *Conomelus anceps*
 pond skater *Gerris costae*
 pond skater *Gerris lacustris*
 pond skater *Gerris lateralis*
 pond skater *Gerris thoracicus*
 shore bug *Saldula* sp.
 Spiked shieldbug (*Picromerus bidens*)
 water boatman *Arctocorisa germari*
 water boatman *Callicorixa wollastoni*
 water boatman *Hesperocorixa sahlbergi*
 water boatman *Sigara nigrolineata*
 water cricket *Velia caprai*
 water cricket *Velia saulii*

Hymenoptera (ants, bees, sawflies & wasps)

ant *Formica lemani*
 ant *Lasius niger*
 ant *Leptothorax acervorum*
 ant *Myrmica ruginodis*
 Bedeguar gall wasp (*Diplolepis rosae*)
 Blaeberry bumblebee (*Bombus monticola*)
 Buff-tailed bumblebee (*Bombus terrestris*)
 Clarke's mining bee (*Andrena clarkella*)
 Common carder bumblebee (*Bombus pascuorum*)
 Common social wasp (*Vespula vulgaris*)
 Cryptic bumblebee (*Bombus cryptarum*)
 Early bumblebee (*Bombus pratorum*)
 Early mining bee (*Andrena haemorrhoea*)
 Field cuckoo bumblebee (*Bombus campestris*)

Forest cuckoo bumblebee (*Bombus sylvestris*)
 furrow bees (*Lasioglossum* sp.)
 Giant horntail (*Urocerus gigas*)
 Gypsy cuckoo bumblebee (*Bombus bohemicus*)
 Heath bumblebee (*Bombus jonellus*)
 Heather colletes (*Colletes succinctus*)
 Honeybee (*Apis mellifera*)
 Northern sallow mining-bee (*Andrena ruficrus*)
 Northern white-tailed bumblebee (*Bombus magnus*)
 Orange-legged furrow-bee (*Halictus rubicundus*)
 Parasitic wasps (*Ophion* sp.)
 Red wasp (*Vespula rufa*)
 Red-tailed bumblebee (*Bombus lapidarius*)
 Rose pea gall wasp (*Diplolepis nervosa / eglanteriae*)
 Sabre wasp (*Rhyssa persuasoria*)
 Sallow sawfly (*Nematius ferruginea*)
 Scabious sawfly (*Abia sericea*)
 Smooth-faced furrow-bee (*Lasioglossum fratellum*)
 Tree wasp (*Dolichovespula sylvestris*)
 White-tailed bumblebee (*Bombus lucorum* agg.)

Isopoda (woodlice)

Common striped woodlouse (*Philoscia muscorum*)
 Common rough woodlouse (*Porcellio scaber*)
 Pygmy woodlouse (*Trichoniscus pusillus*)

Lepidoptera (butterflies and moths)

Angle shades (*Phlogophora meticulosa*)
 Antler moth (*Cerapteryx graminis*)
 Autumnal rustic (*Eugnorisma glareosa*)
 Barred straw (*Gandaritis pyraliata*)
 Beautiful golden Y (*Autographa pulchrina*)
 Beautiful yellow underwing (*Anarta myrtilli*)
 Bird cherry ermine (*Yponomeuta evonymella*) * Palacerigg Country Park
 Blaeberry roller (*Ancylis myrtillana*)
 Blaeberry tortrix (*Aphelia viburnana*)
 Black rustic (*Aporophyla nigra*)
 Bordered white (*Bupalus piniaria*)
 Brimstone moth (*Opisthograptis luteolata*)
 Brindled flat-body (*Agonopterix arenella*)
 Brindled pug (*Eupithecia abbreviata*)
 Broom moth (*Ceramica pisi*)
 Brown china-mark (*Elophila nymphaeata*)
 Brown rustic (*Rusina ferruginea*)
 Brown silver-lines (*Petrophora chlorosata*)
 Buff-tip moth (*Phalera bucephala*)
 Burnished brass (*Diachrysia chrysitis*)
 Canary-shouldered thorn (*Ennomos alniaria*)
 Carrion moth (*Monopis weaverella*)
 Chestnut (*Conistra vaccinii*)
 Cinnabar moth (*Tyria jacobaeae*)
 Clouded border (*Lomaspilis marginata*)

Clouded-bordered brindle (*Apamea crenata*)
 Clouded drab (*Orthosia incerta*)
 Common birch pygmy (*Stigmella betulicola*)
 Common carpet (*Epirrhoe alternata*)
 Common flat-body (*Agonopterix heracliana*)
 Common grass veneer (*Agriphila tristella*)
 Common grey (*Scoparia ambigualis*)
 Common heath (*Ematurga atomaria*)
 Common marbled carpet (*Dysstroma truncata*)
 Common plume (*Emmelina monodactyla*)
 Common pug (*Eupithecia vulgata*)
 Common quaker (*Orthosia cerasi*)
 Common rush case-bearer (*Coleophora alticolella*)
 Common rustic (*Mesapamea secalis*)
 Common tortrix (*Capua vulgana*)
 Common wainscot (*Mythimna pallens*)
 Common white wave (*Cabera pusaria*)
 Common wave (*Cabera exanthemata*)
 Copper underwing (*Amphipyra pyramidea*)
 Coxcomb prominent (*Ptilodon capucina*)
 Dark arches (*Apamea monoglypha*)
 Dark brocade (*Blepharita adusta*)
 Dark green fritillary (*Argynnis aglaja*)
 Dark marbled carpet (*Chloroclysta citrata*)
 December moth (*Poecilocampa populi*)
 Diamond-back moth (*Plutella xylostella*)
 Dotted border (*Agriopsis marginaria*)
 Dotted clay (*Xestia baja*)
 Double square-spot (*Xestia triangulum*)
 Drinker moth (*Euthrix potatoria*)
 Dun-bar (*Cosmia trapezina*)
 Ear moth agg (*Amphipoea* sp.)
 Early grey (*Xylocampa areola*)
 Early tooth-striped (*Trichopteryx carpinata*)
 Elephant hawkmoth (*Deilephila elpenor*)
 Emperor moth (*Saturnia pavonia*)
 Engrailed (*Ectropis bistortata*)
 Feathered thorn (*Colotois pennaria*)
 Festooned roller (*Ancylis geminana*)
 Flame carpet (*Xanthorhoe designata*)
 Flame shoulder (*Ochropleura plecta*)
 Fox moth (*Macrothylacia rubi*)
 Garden grass-veneer (*Chrysoteuchia culmella*)
 Garden tiger (*Arctia caja*)
 Gold spangle (*Autographa bractea*)
 Gold spot (*Plusia festucae*)
 Golden pigmy (*Stigmella aurella*)
 Gothic (*Naenia typica*)
 Grass veneer (*Crambus pascuella*)
 Grey dagger (*Acronicta psi*)
 Grey pine carpet (*Thera obeliscata*)
 Grey rush case-bearer (*Coleophora glaucicolella*)

Green-brindled crescent (*Allophyes oxyacanthae*)
 Green carpet (*Colostygia pectinataria*)
 Green hairstreak (*Callophrys rubi*)
 Green-veined white (*Pieris napi*)
 Haworth's minor (*Celaena haworthii*)
 Heart & dart (*Agrotis exclamationis*)
 Heath rustic (*Xestia agathina*)
 Heath twist (*Philedonides lunana*)
 Heather groundling (*Neofaculta ericetella*)
 Hebrew character (*Orthosia gothica*)
 Hook-streaked grass-veneer (*Crambus lathoniellus*)
 Ingrailed clay (*Diarsia mendica*)
 Inlaid grass-veneer (*Crambus pascuella*)
 Iron prominent (*Notodonta dromedarius*)
 July highflyer (*Hydriomena furcata*)
 Knapweed bell (*Epiblema cirsiiana*)
 Knotgrass (*Acronicta rumicis*)
 Large ear (*Amphipoea lucens*)
 Large emerald (*Geometra papilionaria*)
 Large marble (*Phiaris schulziana*)
 Large white (*Pieris brassicae*)
 Large yellow underwing (*Noctua pronuba*)
 Latticed heath (*Chiasmia clathrata*)
 Lempke's gold spot (*Plusia putnami gracilis*)
 Lesser broad-bordered yellow underwing (*Noctua janthe*)
 Lesser / Common rustic (*Mesapamea* sp.)
 Lesser swallow prominent (*Pheosia gnoma*)
 Light emerald (*Campaea margaritata*)
 Lesser yellow underwing (*Noctua comes*)
 Little cosmet (*Mompha raschkiella*)
 Lunar hornet moth (*Sesia bembeciformis*)
 Lunar marbled brown (*Drymonia ruficornis*)
 Map-winged swift (*Hepialus fusconebulosa*)
 Manchester treble-bar (*Carsia sororiata*)
 Marbled minor agg (*Oligia* sp.)
 March dagger (*Diurnea fagella*)
 March moth (*Alsophila aescularia*)
 Marbled conch (*Eupoecilia angustana*)
 May highflyer (*Hydriomena impluviata*)
 Meadow brown (*Maniola jurtina*)
 Meadow longhorn (*Cauchas rufimitrella*)
 Mottled beauty (*Alcis repandata*)
 Mottled grey (*Colostygia multistrigaria*)
 Mottled umber (*Erannis defoliaria*)
 Narrow-winged pug (*Eupithecia nanata*)
 Neglected rustic (*Xestia castanea*)
 Northern eggjar (*Lasiocampa quercus callunae*)
 Northern spinach (*Eulithis populata*)
 November moth (*Epirrita dilutata*)
 Nut-tree tussock (*Colocasia coryli*)
 Oak beauty (*Biston strataria*)
 Orange tip (*Anthocharis cardamines*)

Orange underwing (*Archiearis parthenias*)
Painted lady (*Vanessa cardui*)
Peacock (*Aglais io*)
Pearl-banded grass veneer (*Catoptria margaritella*)
Pebble prominent (*Notodonta ziczac*)
Peppered moth (*Biston betularia*)
Pine beauty (*Panolis flammea*)
Pine bell (*Epinotia rubiginosana*)
Pine bud moth (*Pseudococcyx turionella*)
Pink-barred sallow (*Xanthia togata*)
Plain gold (*Micropterix calthella*)
Poplar hawkmoth (*Laothoe populi*)
Powdered quaker (*Orthosia gracilis*)
Purple clay (*Diarsia brunnea*)
Puss moth (*Cerura vinula*)
Red admiral (*Vanessa atalanta*)
Red-green carpet (*Chloroclysta siterata*)
Red-lined quaker (*Agrochola lota*)
Red-necked footman (*Atolmis rubricollis*)
Red sword grass (*Xylena exsoleta*)
Riband Wave (*Idaea aversata*)
Ringlet (*Aphantopus hyperantus*)
Rush marble (*Bactra lancealana*)
Rustic shoulder-knot (*Apamea sordens*)
Sallow (*Xanthia icteritia*)
Sallow kitten (*Furcula furcula*)
Scalloped oak (*Crocallis elinguaris*)
Scarce silver Y (*Syngrapha interrogationis*)
Shaded broadbar (*Scotopteryx chenopodiata*)
Shears (*Hada plebeja*)
Silver-ground carpet (*Xanthorhoe montanata*)
Silver Y (*Autographa gamma*)
Six-spot burnet (*Zygaena filipendulae*)
Six-striped rustic (*Xestia sexstrigata*)
Small angle shades (*Euplexia lucipara*)
Small argent & sable (*Epirrhoe tristata*)
Small autumnal moth (*Epirrita filigrammaria*)
Small copper (*Lycaena phlaeas*)
Small dotted buff (*Photedes minima*)
Small fan-footed wave (*Idaea biselata*)
Small heath (*Coenonympha pamphilus*)
Small pearl-bordered fritillary (*Boloria selene*)
Small quaker (*Orthosia cruda*)
Small square-spot (*Diarsia rubi*)
Small tortoiseshell (*Aglais urticae*)
Small wainscot (*Chortodes pygmina*)
Small white (*Pieris rapae*)
Smoky wainscot (*Mythimna impura*)
Smoky wave (*Scopula ternata*)
Spruce carpet (*Thera britannica*)
Square-barred bell (*Epinotia tetraquetra*)
Square-spot rustic (*Xestia xanthographa*)

Straw dot (*Rivula sericealis*)
Svensson's copper underwing (*Amphipyra berbera*)
Swallow-tailed moth (*Ourapteryx sambucaria*)
The Chevron (*Eulithis testata*)
The Miller (*Acronicta leporina*)
The Spectacle (*Abrostola tripartita*)
True lover's knot (*Lycophotia porphyrea*)
Twin-spot carpet (*Perizoma didymata*)
Twin-spot plume (*Stenoptilia bipunctidactyla*)
Twin-spot quaker (*Orthosia munda*)
Vapourer (*Orgyia antiqua*)
Water carpet (*Lampropteryx suffumata*)
Willow beauty (*Peribatodes rhomboidaria*)
White blotch bell (*Epinotia trigonella*)
White ermine (*Spilosoma lubricipeda*)
White sallow bell (*Epinotia subocellana*)
White streak (*Pleurota bicostella*)
Winter moth (*Operophtera brumata*)
Woodland marble (*Orthotaenia undulana*)
Wood tiger (*Parasemia plantaginis*)
Yellow-barred gold (*Micropterix aureatella*)
Yellow horned (*Achlya flavicornis*)
Yellow-lined quaker (*Agrochola macilenta*)
Yellow shell (*Camptogramma bilineata*)

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*)
Garlic snail (*Oxychilus alliarius*) #
Hedgehog slug (*Arion intermedius*)
Marsh slug (*Deroceras laeve*)
Rounded snail (*Discus rotundatus*) #
Slippery snail (*Cochlicopa lubrica*) #
New Zealand mudsnail (*Potamopyrgus antipodarum*)

Myriapods (centipedes and millipedes)

Black snake millipede (*Tachypodoiulus niger*)
Blunt-tailed snake millipede (*Cylindroiulus punctatus*)
Orange striped millipede (*Ommatoiulus sabulosus*)
Flat-backed millipede (*Polydesmus* sp.)

Neuroptera (lacewings)

green lacewing *Chrysopa carnea*

green lacewing *Chrysopa perla*

Odonata (dragonflies and damselflies)

Azure damselfly (*Coenagrion puella*)

Black darter (*Sympetrum danae*)

Blue-tailed damselfly (*Ischnura elegans*)

Common blue damselfly (*Enallagma cyathigerum*)

Common darter (*Sympetrum striolatum*)

Common hawkler (*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*)

Opilliones (harvestmen)

harvestman *Mitopus morio*

harvestman *Paroligolophus agrestis*

Orthoptera (grasshoppers and crickets)

Common green grasshopper (*Omocestus viridulus*)

Field grasshopper (*Chorthippus brunneus*)

Plecoptera (stoneflies)

Early needle fly (*Leuctra hippopus*)

Small brown stonefly (*Nemoura cinerea*)

Pseudoscorpiones (Pseudoscorpions)

Common moss nipper (*Neobisium carcinoides*)

Trichoptera (Caddisflies)

Cinnamon sedge (*Limnephilus griseus*)

caddisfly *Limnephilus lunatus*

caddisfly *Plectrocnemia conspersa*

caddisfly *Rhadicoleptus alpestris*

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*)

Smooth newt (*Lissotriton vulgaris*) * Recorded at Palacerigg Country Park

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