EARBA STORAGE

A GILKES ENERGY COMPANY

Earba Pumped Storage Hydro Scheme

EIA Report

Appendix 8.6: Outline Biodiversity Enhancement and Management Plan (OBEMP)

February 2024

Quality Information

Prepared by	Checked by	Approved by
SLR Consulting	Chris Pasteur	Gavin McGill

Revision History

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EIA APPENDIX 8.6: Outline Biodiversity Enhancement and Management Plan

Earba Pumped Storage Hydro Scheme

Earba Limited

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Basis of Report

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1.0 Introduction

1.1 Background

SLR Consulting (SLR) was commissioned by Earba Limited ('The Applicant') to produce an Outline Biodiversity Enhancement and Management Plan (OBEMP) for the proposed Earba Pumped Storage Hydro (PSH) Scheme, to accompany the Environmental Impact Assessment (EIA) Report for the Proposed Development. This report forms the OBEMP.

1.2 Site Description

The Proposed Development is situated approximately 30 km southwest of Kingussie, on the Ardverikie Estate to the south of Loch Laggan and approximately mid-way between Newtonmore and Spean Bridge, Highlands.

The 'Site' refers to all land within the red line planning boundary. Lochan na h-Earba (referred to within this report as 'Loch Earba'), made up of two connecting lochs, is located in the central and northern parts of the Site, and drains into Loch Laggan to the north, via the Allt Labhrach watercourse. Loch a' Bhealaich Leamhain (referred to in this report as 'Loch Leamhain') is located in the southeast corner of the Site, on higher ground, and also drains to Loch Laggan, via the Allt Loch a' Bhealaich Leamhain ('Allt Leamhain'), the Allt Cam, Loch Pattack and the River Pattack. The River Spean forms the Site boundary at the westernmost spur, adjacent to the A86 road where the Site access is proposed. The Site also supports a number of smaller burns, most of which feed into Loch Earba.

Baseline conditions are detailed in EIA Volume 1, Chapter 8: Terrestrial Ecology, Chapter 9: Forestry, Chapter 10: Ornithology, Chapter 11: Aquatic Ecology and Chapter 12: Geology, Soils and Water, and associated EIA Technical Appendices.

Detailed Phase 1 habitat, National Vegetation Classification (NVC) and protected mammal surveys have been carried out in 2023 for the proposed infrastructure footprint and 250 m buffer (the Survey Area, comprising a total area of over 1,650 ha, with an altitudinal range from 250 m to 850 m).

The Survey Area primarily comprises wet and dry dwarf shrub heath, *Molinia caerulea* dominated marshy grassland, and upland and montane (>600 m) blanket bog, some of which is degraded. Smaller patches of semi-natural conifer and broadleaf woodland were recorded around Loch Earba and along the river Spean. Small areas of uncommon and sensitive montane habitats are present at higher altitudes, primarily surrounding the Loch Leamhain area, including montane willow scrub, montane flushes and springs, species-rich ledges and montane heath.

This OBEMP extends beyond the Site boundary and covers a much wider area, encompassing the majority of Ardverikie estate. Ardverikie estate supports a range of habitats, including extensive heathlands, peatlands, woodland and montane habitat. The Site boundary, Ardverikie estate boundary, and proposed BEMP areas, are illustrated in Figure 8.6.1.

1.3 Details of Proposed Development

The Proposed Development would create a large-scale, long duration electricity storage scheme with up to 1800 MW generation capacity, and a storage capacity of 40 Gigawatt hours (GWhr). The Proposed Development would operate by transferring water between a lower reservoir, Loch Earba, and an upper reservoir, Loch Leamhain. The maximum water level of these existing lochs would be raised by constructing dams to increase their natural

storage capacity. The reservoirs would be connected by an underground waterway system including up to three headrace tunnels.

A full description of the Proposed Development is provided in Volume 1, Chapter 2 of the EIA Report.

1.4 Purpose and Scope of this Report

This OBEMP outlines proposed habitat restoration and management measures that would form part of the Proposed Development.

It details the habitat management and monitoring that is proposed to compensate for the direct loss and indirect effects of sensitive / semi-natural habitats, notably blanket bog, heathland, native woodland and sensitive montane habitats, and to provide significant biodiversity enhancements, in accordance with planning policy requirements, including National Planning Framework 4 (NPF4).

This OBEMP is intended as a precursor to a more detailed Biodiversity Enhancement and Management Plan (BEMP), which would be produced and agreed with The Highland Council (THC), in consultation with NatureScot and Scottish Environment Protection Agency (SEPA) post consent, prior to the commencement of construction. It is not the intention for this document to provide full details of proposed management, many of which cannot be determined fully at this stage.

Issues relating specifically to the construction of the Proposed Development (e.g. pollution control, disturbance to fauna) are not considered here. Further information about ecological mitigation measures to be employed during the construction period is included in EIA Report Volume 1, Chapters 8 – 12. An outline Construction Environmental Management Document (CEMD) is also included in Appendix 2.3 of the EIA Report.

The spatial scope of the OBEMP is contained within the Ardverikie Estate (see Figure 8.6.1). The outline proposals presented here have been discussed and agreed with the landowner, Ardverikie Estate.

The BEMP would remain in place for the lifetime of the development.

1.5 Relevant Consultation

A BEMP was requested by THC in their pre-application advice dated 8th March 2023, detailing how NPF 4, Policy 3, and Highland-wide Local Development Plan Policies 57 – 60, will be met, by demonstrating that the Proposed Development will significantly enhance the biodiversity of the Site from its pre-development state.

THC and NatureScot have been consulted on emerging proposals for the OBEMP, throughout its development. Issues raised that are directly relevant to this OBEMP are summarised in Table 1-1. The proposals have evolved throughout the consultation process, and the final proposals presented within this OBEMP take account of consultation feedback received to date. This OBEMP outlines the rationale for selection of the final proposal option, in favour of an earlier iteration. Further detail on alternative options, and the rationale for selection of the final option, is provided in Appendix 8.6.2.

Table 1-1: BEMP Consultation Summary

Consultation Type	Summary of Issues Raised	Response / Action Taken
THC & NatureScot (01.08.23): meeting to discuss approach to compensation and enhancement	THC and NatureScot highlighted that a 10:1 restoration ratio, in accordance with most recent guidance[1], is expected for bog compensation, including specifically for montane bog. THC confirmed that there is no specific requirement to use the Natural England metric, nor any other metric, when demonstrating compensation and significant enhancement. A metric can however be used for ease of demonstrating enhancement. Should a metric be applied, this should exclude irreplaceable habitat which should be addressed under bespoke compensation agreements (i.e. through liaison with NatureScot for priority peatland and THC's Forestry Officer for ancient woodland). The possibility of offering different bespoke compensation and enhancement options, which would not necessarily fit into like-for-like compensation or metric trading rules, but which would offer wider benefits (such as additional woodland creation / regeneration / re-wilding / deer control / catchment enhancement), was discussed and agreed to be acceptable in principle. The option of deer control could be considered as an enhancement measure as part of proposals for heathland restoration or woodland creation. Meaningful enhancements should be demonstrated and a holistic approach applied.	Feedback from the consultation meeting was used to develop bespoke compensation and enhancement proposals, with further consultation on development of the proposals undertaken subsequently (see below).
THC & NatureScot (5.12.23): meeting to discuss emerging compensation and enhancement proposals	An overview document of emerging biodiversity compensation and enhancement proposals was provided to NatureScot and THC, to allow for comment and ongoing input. In summary, the overview proposals included: 813 ha of peatland restoration, 68 ha of native woodland creation, reduced deer numbers (8 per km^2) across c. 14,000 ha, Rhododendron and bracken control, and a range of aquatic and species-specific features. The key comments provided are summarised below. Peatland Restoration and Deer Management: NatureScot's peatland adviser was unfortunately unable to attend, and therefore detailed comments relating to peatland restoration were not able to be provided. Deer management was discussed, and concerns were expressed that the 8 deer per km^2 proposed in the initial outline could be too high for peatland / montane bog restoration. A proposed targeted and adaptive	The initial outline proposals have been substantially revised, and additional information provided, to address consultee comments received, particularly comments relating to deer. Section 5 of this OBEMP document outlines the revised proposals, with the rationale for the revised proposals provided in Section 5.3.

[1] NatureScot (June 2023) Advising on Peatland, Carbon-rich Soils and Priority Peatland Habitats in Development Management. [online] Available at https://www.nature.scot/doc/advising-peatland-carbon-rich-soils-and-priority-peatland-habitats-development-management [Accessed in August 2023]. This guidance has since been revised (November 2023).

Consultation Type	Summary of Issues Raised	Response / Action Taken
	approach to deer management was discussed, and there was an acknowledgement that site-specific deer management is likely to be more important than the overall reduction in numbers estate-wide in terms of effects on proposed restoration areas. NatureScot's deer expert provided further written comments after the meeting (dated 12.12.23), which stated: "A density of 7-8 deer per km^2 directly on upland blanket bog is likely to heavily impact on habitat and therefore any restoration. However, if this is the average density over the wider estate, blanket bog may not be as impacted as it is a less favoured habitat for deer, and actual densities / utilisation on the bogs are likely to be lower than surrounding habitat. That said, an average density of 7-8 per km^2 will be too high to protect and restore more sensitive habitats such as native woodlands, willow scrub and the other montane communities identified on the estate. I would advise, for biodiversity enhancement, the plan should be aiming to manage the deer population so that these rare and more sensitive communities are also improved alongside blanket bog… A dedicated deer management plan should incorporate a population model detailing how the prescribed culling regime will deliver and maintain the appropriate density over the area of ground available post losses / exclusion.… The deer management plan should also incorporate a regime of regular (ideally annual) monitoring of herbivore impacts to the estate's priority habitats. In order to maintain low impacts in priority habitats culling targets in the plan will need to be adaptive for however long it takes for restoration to be successful." Tree Planting: It was confirmed that deer fencing would be used around tree planting areas. THC's forestry officer provided written comments after the meeting (dated 11.12.23): THC's forestry officer confirmed that much of the woodland loss on site would have to be considered against NPF4 Policy 6 b)ii which notes that '*Development proposals will not be supported where they will result in… Adverse impacts on native woodlands, hedgerows and individual trees of high biodiversity value*…' However, the amount of compensatory woodland planting proposed in comparison with the level of total woodland removal could on this occasion be accepted providing there is a detailed and robust Compensatory Planting Plan supplied in support of any subsequent planning application. Ornithology: THC confirmed that the peatland restoration proposals would be positive for birds.	Further information on deer management and woodland proposals, along with a detailed rationale for the revised proposals and approach to deer management, including population model information is provided in Appendix 8.6.2. The report provided in Appendix 8.6.2 has been produced by Victor Clements, a deer and woodland specialist. Ornithology comments have also been addressed in this OBEMP document. Information on diver platforms is provided in Section 5.5.7.5, and the rationale for exclusion of artificial raptor nest sites is provided in Section 5.2.

Consultation Type	Summary of Issues Raised	Response / Action Taken
	THC recommended including artificial nest sites for breeding raptors, with peregrine and osprey nest sites specifically discussed. THC commented that they would like to see evidence of whether changing water levels would impact diver raft proposals. Other Matters: THC confirmed that they would want to see a general idea of the rough habitat areas involved in the deer control areas proposed for wet heath compensation, to give confidence that sufficient heath areas are included. Desk-based habitat overview information should therefore be provided in the OBEMP. THC queried whether the proposed re-wetting of the Allt Labhrach could count towards enhancement on additionality grounds, if it is a SEPA requirement. THC confirmed that a minimum of 30 years of management / monitoring would be expected as part of the BEMP. THC's planning officer confirmed that he could not see any issues with the compensation / enhancement proposals being outside of the red line boundary, subject to appropriate legal agreements being in place.	
NatureScot & THC (22.1.24): invitation to comment on revised outline proposals	Victor Clements' report (provided in Appendix 8.6.2, with minor revisions), outlining revised proposals, was provided to THC and NatureScot for comment. There has been insufficient time to hold a further meeting or conduct a site visit ahead of the submission of the planning application. However, THC's Ecology Officer has verbally provided some initial comments on the revised proposals, summarised as follows: A concern over whether the proposed deer numbers are compatible with deliverability of the peatland restoration was raised. More emphasis on heathland was raised. Re-wetting of the Allt Labhrach being a SEPA requirement was also raised. NatureScot's deer advisor provided comments on the revised proposals (in an email dated 2.2.24), summarised as follows: It was agreed that reducing the overall deer population density to 8 deer/km^2 across the estate is likely to benefit blanket bog, with existing information indicating that current herbivore impacts are sufficient to maintain the blanket bog and wet heath in its present state and possibly allow further recovery of these communities. However, other sensitive habitats (native woodland, Alpine summit communities of moss, sedge and three-leaved rush, siliceous scree, upland tall herb communities, and montane willow scrub) are less tolerant of deer pressure. If the scheme is also aiming to enhance those more sensitive plant communities, more ambitious culling would be required.	Further details on heathland compensation are provided within this OBEMP document. Information on the additionality of re-wetting of the Allt Labhrach is provided in Section 5.3.3. The proposals aim to enhance the habitats which are more sensitive to deer browsing within the large deer exclosure (see Section 5.3.2.1 for further details). The proposals include a commitment to removing the exclosure in the longer-term, once suitable conditions

Consultation Type	Summary of Issues Raised	Response / Action Taken
	Where woodland creation or restoration is proposed, densities of c. 8 deer/km^2 are likely to be too high for maintaining woodland regeneration without initially excluding deer. Fenced exclosures would be necessary in the short term, but support for exclosures should be under the condition that they can only ever be a stopgap. Any agreed plan should ensure that fenced exclosures are reinforced by appropriate management, which ideally enables deer to return after a defined period of time, without a return of adverse impacts to the woodland flora. To compensate for the initial loss of shelter and forage by the construction of large fenced exclosures, additional levels of culling will be initially required to minimise the displacement of deer impacts onto neighbouring habitats. NatureScot's peatland advisor provided comments (by email dated 9.2.24) summarised as follows: It was agreed that the scale of restoration (restoring 600 ha to compensate for the loss of 73.91 ha of bog habitats) is reasonable, although it could closer align to the recommendations of NatureScot's guidance of 1:10 loss:restoration. The proposal to restore large areas of montane peatland was welcomed. It was advised that a review of the proposal should consider a small increase to the total area restored, but more importantly consideration of hydrological units should be carried out. It was commented that it is not clear how successful the restoration is likely to be as the proposed work is focused on the least damaged (and easiest to restore) areas, but as they are linked to areas which have greater erosion, the success of these areas is less likely as they will have greater pressure on them from increased runoff from the more eroded areas. Another option would be to focus on all suitable restoration areas within specific locations. It was strongly recommended that the peatland restoration aim should be to achieve restoration of 'hydrological units' and focus on restoration of areas which the restoration is likely to be sufficient for the whole area to recover in time. This would result in the most benefit from the restoration work.	have been reached and can be maintained. Details of a deer population model for appropriate culling levels to support the deer management proposals are provided in Appendix 8.6.3. The proposed extent of peatland restoration has been increased from 600 ha, up to 625 ha. Information relating to peatland restoration and hydrological units is provided in Appendix 8.6.4. Peatland restoration will prioritise restoring suitable areas within specific hydrological units, with the aim of achieving restoration of hydrological units. The final peatland restoration areas to be restored would be determined via further survey work and risk assessment, during development of the detailed BEMP post-consent.

1.6 Approach to providing Biodiversity Net Gain

The approach to providing Biodiversity Net Gain used here involves the development and agreement of bespoke compensation and enhancement, rather than following a metric approach, for the following reasons. A key element of compensation and enhancement proposed comprises substantial peatland restoration, for which a bespoke approach is required under the current Defra Metric, informed by current NatureScot guidance[1]. Loss of an area mapped on the Ancient Woodland Inventory also requires the agreement of bespoke compensation under the Defra Metric. For the remaining habitats, bespoke compensation and enhancement proposals, outside of a metric are also considered more appropriate. This is due to the nature of the scheme and habitats affected, and the habitat improvement options available within the Site and wider estate, which do not necessarily lend themselves to metric trading rules. The proposals outlined within this document are considered to be the most appropriate for the estate and local setting, within the constraints of estate management and landowner requirements, with significant conservation benefits.

1.7 Evidence of Technical Competence and Experience

This OBEMP has been authored by Hazel Douglas MCIEEM MBiolSci, Associate Ecologist with SLR Consulting. Hazel has ten years' experience within ecological consultancy, and is a competent and experienced terrestrial ecologist, who specialises in Ecological Impact Assessment.

This report has been technically reviewed by Duncan Watson MCIEEM CEnv, Technical Director with SLR Consulting. Duncan is an Ecologist with over 25 years' professional experience, much of which relates to projects in the renewable energy sector.

This document has been compiled incorporating specialist input from Angus Davidson Ltd (ADL) for peatland restoration (see Appendix 8.6.1), and Victor Clements for deer management and woodland creation (see Appendices 38.6.2 and 8.6.3). Author details are contained within the respective appendices.

Aquatic measures have been provided by the appointed project aquatic consultant (refer to EIA Volume 1, Chapter 11: Aquatic Ecology), and ornithological measures by the appointed project ornithology consultant (refer to EIA Volume 1, Chapter 10: Ornithology).

2.0 Methodology

The aim of this OBEMP is to establish the key objectives and principles by which parts of the Site and surrounding areas across the Ardverikie Estate would be restored and managed to the benefit of biodiversity, which would then form the basis for a more detailed BEMP, post consent.

This OBEMP has been prepared with reference to relevant peatland restoration, deer management, and other habitat management guidance[2,3,4,5,6,7,8,9,10].

2.1 Hierarchy of Terms for Restoration Planning

The following terms[11] have been used to structure this OBEMP:

- The **Scope** is the broad geographic or thematic focus of the project.
- The **Vision** is a general summary of the desired condition one is trying to achieve through the work of the project.
- The **Targets** identify the native ecosystems to be restored as informed by the reference model, along with any social outcomes or constraints expected of the project.
- **Goals** are formal statements of the medium to long-term desired ecological or social condition, including the level of recovery sought. Goals must be clearly linked to targets, measurable, time-limited, and specific.

[2] NatureScot (2016). *Planning for development: What to consider and include in Habitat Management Plans. Version 2.* Retrieved from https://www.nature.scot/guidance-planning-development-what-consider-and-include-habitat-management-plans [Accessed in December 2023].

[3] NatureScot (2016). *Planning for Development: What to consider and include in deer assessments and management at development sites. Version 2*. Retrieved from https://www.nature.scot/sites/default/files/2019-08/Guidance%20-%20Planning%20and%20Development%20-%20What%20to%20Consider%20and%20Include%20in%20Deer%20Assessments%20and%20Management%20at%20Development%20Sites.pdf [Accessed in December 2023]

[4] NatureScot (2022) *Peatland ACTION – Technical Compendium*. Retrieved from: https://www.nature.scot/doc/peatland-action-technical-compendium [Accessed in December 2023]

[5] IUCN (2023) *Peatland Code. Version 2.0*. Retrieved from https://www.iucn-uk-peatlandprogramme.org/sites/default/files/2023-03/Peatland%20Code%20V2%20-%20FINAL%20-%20WEB_1.pdf [Accessed in December 2023]

[6] Gilbert, O. L., & Anderson, P. (1998). *Habitat Creation and Repair.* New York: Oxford University Press

[7] NatureScot (2023) Advising on peatland, carbon-rich soils and priority peatland habitats in development management. Published June 2023, revised November 2023. Retrieved from https://www.nature.scot/doc/advising-peatland-carbon-rich-soils-and-priority-peatland-habitats-development-management [Accessed in January 2024]

[8] Scottish Government (2008) Scotland's Wild Deer: A National Approach. Retrieved from: https://www.webarchive.org.uk/wayback/archive/20220126143540mp_/https://www.nature.scot/sites/default/files/2017-06/C249895%20-%20Scotlands%20Wild%20Deer%20-%20A%20National%20Approach%20November%202008%20DCS.pdf [Accessed in December 2023]

[9] Scottish Natural Heritage (2012) Code of Practice on Deer Management. Retrieved from https://www.nature.scot/professional-advice/land-and-sea-management/managing-wildlife/managing-deer/code-practice-deer-management [Accessed in December 2023]

[10] https://bestpracticeguides.org.uk/impacts/ [Accessed in December 2023]

[11] Society for Ecological Restoration (2019) International Principals and Standards for the Practice of Ecological Restoration: Second Edition. International Standards for the Practice of Ecological Restoration - Society for Ecological Restoration (ser.org).

- **Objectives** are formal statements of the interim outcomes along the trajectory of recovery. Objectives must be clearly linked to targets and goals, and be measurable, time-limited, and specific.

2.2 Baseline Data Collection

This OBEMP has been informed by data collected for the desk-study, habitat and species-specific surveys, carried out as part of the EIA. Full details are provided in the relevant appendices to the EIA Report, and a summary is provided below:

- Desk study of protected and notable species records and non-statutory designated sites within 2 km of the Site supplied by Highland Biological Recording Group (HBRG) (data obtained in January 2023), and National Biodiversity Network (NBN) Atlas[12] (for contextual species information);
- Habitat Survey report[13], which provides baseline Phase 1 and National Vegetation Classification (NVC) survey results for the proposed infrastructure footprint and 250m buffer, undertaken in July 2023 using standard methodology[14,15];
- Protected Mammal Survey report[16], which provides results of baseline surveys for otter *Lutra lutra*, water vole *Arvicola amphibius*, badger *Meles meles*, red squirrel *Sciurus vulgaris*, pine marten *Martes martes* and Scottish wildcat *Felis silvestris*, for the proposed infrastructure footprint and 250m buffer, undertaken in summer 2023 using standard methodologies[17,18,19,20,21,22];
- Bat Survey report[23], which provides results of bat habitat and preliminary roost assessments, bat activity survey (using static detector sampling) and bat emergence / re-entry surveys of trees within the Site, undertaken in summer and autumn 2023, in line with guidance in place at the time of survey[24,25];
- Bird survey reports[26,27], which provide results of three rounds of breeding bird surveys undertaken between April and late-July 2022, three rounds of wintering bird

[12] www.nbnatlas.org [Accessed in September 2023]

[13] Tracks Ecology (2023) Habitat Survey. Loch Earba Pump Storage Hydro. 23/022/CAI/R01

[14] JNCC (2010), Handbook for Phase 1 Habitat Survey – a technique for environmental audit. Joint Nature Conservation Committee: Peterborough.

[15] Rodwell, J.S. (2006) NVC Users' Handbook, JNCC, Peterborough.

[16] Tracks Ecology (2023) Protected Mammal Survey. Loch Earba Pump Storage Hydro. 23/022/CAI/R02

[17] Bang, P. and Dahlstrøm, P. (2001) *Animal Tracks and Signs*. Oxford University Press.

[18] Sargent, G. and Morris, P. (2003) *How to find and identify mammals*. The Mammal Society, London.

[19] Davis, A. R. & Gray, D. (2010) *The distribution of Scottish wildcats (Felis silvestris) in Scotland (2006-2008).* Scottish Natural Heritage Commissioned Report No. 360.

[20] Scottish Natural Heritage (2011) Scottish Wild Cat Naturally Scottish Series. SNH Battleby. http://www.snh.org.uk/pdfs/publications/naturallyscottish/wildcats.pdf [Accessed in September 2023]

[21] Neal, E. and Cheesman, C. (2006) *Badgers*. Poyser Natural History, Cambridge, UK.

[22] Dean, M., Strachan, R., Gow, D. and Andrews, R. (2016). *The Water Vole Mitigation Handbook* (The Mammal Society Mitigation Guidance Series). Eds Fiona Matthews and Paul Chanin. The Mammal Society, London.

[23] Tracks Ecology (2023) Bat Survey. Loch Earba Pump Storage Hydro. 23/022/CAI/R03

[24] Collins, J. (2016) Bat Surveys for Professional Ecologists. Good Practice Guidelines. Third edition. Bat Conservation Trust, London.

[25] Bat Conservation Trust (2022) Interim Guidance Note: Use of night vision aids for bat emergence surveys and further comment on dawn surveys.

[26] Mike Coleman Ecology (2023) Earba Pumped Storage Hydro Scheme. Ornithology Report.

[27] Mike Coleman Ecology (2023) Earba Pumped Storage Hydro Scheme. Breeding Bird Survey 2023 Report.

surveys undertaken between October 2022 and March 2023, and further targeted breeding bird surveys undertaken between early May and early July 2023, based on standard methodologies[28,29];

- Volume 1, Chapter 11: Aquatic Ecology and Appendix 11.1 of the EIA Report, which provides details of aquatic baseline surveys undertaken by Gavia Environmental Limited, involving macroinvertebrate surveys, macrophyte surveys, water quality monitoring, and fish habitat and ecology surveys, undertaken between autumn 2022 and autumn 2023. Aquatic surveys included Loch Leamhain, Loch Earba, and associated watercourses within the Site; and
- The following chapters from Volume 1 of the EIA Report, where methods of data collection and results are described: Chapter 6: Hydrology and Water Management, Chapter 8: Terrestrial Ecology, Chapter 10: Ornithology, Chapter 11: Aquatic Ecology, Chapter 12: Geology, Soils and Water.

Desk-based and field survey work to identify suitable areas for peatland restoration across the wider Ardverikie estate has been undertaken by Angus Davidson Ltd (ADL). Areas were initially identified using a desk-top study, utilising data sources such as the 2016 Carbon and Peatland Map[30], NBN gateway[31], and aerial imagery. Areas of potential suitability were then surveyed via walkover and drone survey in 2023, to record the Phase 1 habitat types[14], and determine their suitability for restoration. Full details are contained within ADL's Phase 1 Overview / Peatland Restoration Assessment, provided in Appendix 8.6.1. A further review of potential peatland restoration areas has also been undertaken by ADL (see Appendix 8.6.4), to identify both the hydrological catchments (specific watersheds) within Ardverikie Estate, and to propose an approximate programme of peatland restoration that takes into account a range of site-specific factors. This additional review has been undertaken to address comments provided by NatureScot's peatland advisor, to consider peatland restoration of hydrological units.

Potential options for woodland restoration and deer exclosures were developed by Victor Clements (see Appendix 8.6.2), informed by a combination of a site visit in January 2024, desk study review, landowner discussion, and knowledge of the Ardverikie estate and surrounding areas.

Desk-based information on existing habitats across the wider Ardverikie estate was gathered from the Scotland Land Cover Map LC88 database, aerial photography, and historical Herbivore Impact Assessment (HIA) data for Ardverikie.

[28] Brown, A. F. & Shepherd, K. B. (1993) A method for censusing upland breeding waders. *Bird Study*, 40: 3, 189-195

[29] BTO Breeding Bird Survey method, Available online at: https://www.bto.org/our-science/projects/breeding-bird-survey/about-breeding-bird-survey [Accessed in July 2023]

[30] NatureScot (2016) Carbon and Peatland 2016 map. Retrieved from https://www.nature.scot/professional-advice/planning-and-development/planning-and-development-advice/soils/carbon-and-peatland-2016-map [Accessed in August 2023]

[31] https://scotland-records.nbnatlas.org/explore/your-area#56.9541|-4.4557|12|ALL_SPECIES [Accessed in August 2023]

3.0 Baseline Data and Impact Assessment Summary

Baseline data and impact assessment are set out in the EIA Report. The key effects upon important ecological features are summarised in Sections 3.1 – 3.2 below.

3.1 Habitats

A total of 310.2 ha of habitat would be permanently lost (via infrastructure or the inundation zone), and 103.8 ha would be temporarily or indirectly affected. Of this, 231.1 ha of direct loss and 84.8 ha of temporary / indirect effects comprises habitats of local value or greater.

Table 3-1 summarises habitats of local importance or greater that would be affected by the Proposed Development, for which a significant effect is predicted.

In addition to the habitats listed below, the Proposed Development would also result in the loss of a number of habitats assessed as having less than local ecological importance (i.e. not considered to be important ecological features), namely: coniferous plantation woodland, marsh / marshy grassland (species-poor forms of NVC community M25), unimproved acid grassland (U4d, U4e, U6d), bracken (U20a, U20c), scrub (W23), basic scree and other exposure, and existing tracks (totalling 98.1 ha). Small areas of locally important semi-improved acid grassland (U4b), dry dwarf shrub heath: acid and basic (H10a, H10b, H18a, H18b, H20d, H21a, H10d), dry dwarf shrub heath / acid grassland mosaic (H18a / H22a / U4d), bryophyte-dominated spring (M31), swamp (S9a) and marginal / inundation (S10a) would also be lost (3.57 ha in total), which has been assessed as non-significant (due to the scale and / or nature of the loss and local context).

Table 3-1 Summary of Habitat Loss comprising a Significant Effect

Phase 1 Name	NVC Community Name	Habitat Loss from Permanent Infrastructure[32]	Temporary Habitat Loss from Working Corridor / Indirect Loss[33] (ha)	Total Loss (ha)	Significance of effect
A1.1.1: Woodland: Broadleaved - semi-natural	W4b*, W4c*, W7a*, W9b, W11b, W11c, W11d, W17b, W17c, W17d (inc. in mosaic with H18a, M25a*, M15b*, M15c*, CG11a*, CG11b*, CG10b*, H21a, conifer plantation)	0.49	1.32	1.81	Significant at a local level

[32] This includes habitats present within the footprint of the Proposed Development, including the inundation area, and also includes areas which would be subject to cut and fill, grading and pipe laying.

[33] This includes areas within the working corridor (including construction laydown areas) that will be disturbed / damaged during construction, and reinstated following construction where feasible. Indirect loss has also been calculated for bog habitats which lie within 30 m of infrastructure, to allow for drying effects and vegetation changes due to construction works. The 30 m buffer accords with NatureScot guidance, and is considered precautionary. This buffer has been reduced for widening of existing tracks to 3 m (i.e. the width of track widening), on the basis that additional drying effects would not occur where tracks have already been constructed. Additional drying effect buffers have also not been applied where floating tracks would be used, on the basis that drying effects are not predicted in this circumstance. For other wet habitats (i.e. marsh / marshy grassland, wet heath, flush and spring habitat) a 10 m indirect drying effect buffer has been applied from infrastructure. The 10 m buffer is in line with similar assessments for other projects, and although arbitrary, is considered precautionary based on experience at other sites.

Phase 1 Name	NVC Community Name	Habitat Loss from Permanent Infrastructure[32]	Temporary Habitat Loss from Working Corridor / Indirect Loss[33] (ha)	Total Loss (ha)	Significance of effect
A1.2.1: Woodland: Coniferous - semi-natural	W18 Molinia, W18b, W18d (in mosaic with W17b, W4c*, M15a*, M25a*)	2.88	2.59	5.48	Significant at a local level
A1.3.1: Woodland: Mixed - semi-natural	W17 Molinia / W18 Molinia	0.32	-	0.32	Significant at a local level
A2.2: Scrub - scattered	W20*	Too small to map	Too small to map	Too small to map	Significant at a national level
B1.1: Acid grassland - unimproved	U4a, U4b (inc. in mosaic with U4d, U4e, M25b*, CG10a*, H18a, scattered birch)	14.72	4.80	19.52	Significant at a local level
B3.1: Calcareous grassland: Unimproved (inc. calcareous grassland / exposed rock mosaic)	CG10a*, CG10b* (inc. in mosaic with U4a, U4d, M25b*, H10a, dry rocky riverbed)	0.65	0.45	1.10	Significant at a local level
	CG11a*, CG11b*	(included as small part of mosaics under other habitat types) (making up to 3.64 ha)	(included as small part of mosaics under other habitat types) (making up to 0.54 ha)	(included as small part of mosaics under other habitat types) (making up to 4.18 ha)	Significant at a County level
B5: Marsh / marshy grassland	M25a* base-rich (inc. in mosaic with M25a*, M15b*, H10a, H10d base-rich, CG11b*)	14.77	4.06	18.83	Significant at a County level
C2: Upland species-rich ledges	U17b*	Too small to map	-	Too small to map	Significant at a County level
D1.1 / B3.1 Dry dwarf shrub heath / calcareous grassland mosaic	H10a / H14b / H18a / H21a / H22a / CG11a / CG11b* / (inc. in mosaic with U6* base-rich, U20b, M25a*, M15b*, M15c*, U13a, U4a)	8.01	1.08	9.10	Significant at a local level
D2: Wet dwarf shrub	M15a*, M15b*, M15c*, M15d*, M15 *montane (inc.	124.67	54.98	179.65	Significant at a local level

Phase 1 Name	NVC Community Name	Habitat Loss from Permanent Infrastructure[32]	Temporary Habitat Loss from Working Corridor / Indirect Loss[33] (ha)	Total Loss (ha)	Significance of effect
heath (inc. in mosaic with exposed rock)	in mosaic with M31*, H10a, H10b, H14b, H18a, M19c, M25a*, M25b*, U4d, CG11a*, CG11b*, M6b*, U6d*, U4a, U13a, H22b, M17a, M17c, W23a, rock)				
D4: Montane heath / dwarf herb	U13a, U13b (inc. in mosaic with M15* montane, H18a, H22a, M15b*, CG11b*)	1.20	0.07	1.27	Significant at a County level
E1.6.1: Bog: Blanket bog (non-montane)	M17a, M17c, M18a, M19c (inc. in mosaic with M15b*, M25a*, M17b, Phragmites, M3, H10b, H22b)	8.74	6.78	15.52	Significant at a County level
E1.6.1: Bog: Blanket bog (montane)	M19c (inc. in mosaic with M15b*, H10b, H22b, M20)	40.74	2.39	43.13	Significant at a County to National level
E1.7: Bog: Wet modified bog (non-montane)	M17b, M2b, M3 (inc. in mosaic with M17a, M15b*)	0.03	0.59	0.62	Significant at a County level
E1.8: Bog: Dry modified bog (montane)	M19c (inc. in mosaic with M15b*, M20)	9.50	5.21	14.71	Significant at a County to National level
E4: Bare peat	n.a.	0.12	0.05	0.17	Significant at a local level
E2.1: Flush and spring: Acid / neutral flush	M6b* (in mosaic with U6d*)	0.91	0.11	1.02	Significant at a local level
E2.2: Flush and spring: Basic flush	M11a*	Too small to map	-	Too small to map	Significant at a County level
E2.3 Flush and spring – bryophyte-dominated	M37	Too small to map	Too small to map	Too small to map	Significant at a County level
G2 Running water	n.a.	2.69 km	-	2.69 km	Significant at a local level

Communities marked with a '' are potential Groundwater Dependent Terrestrial Ecosystem (GWDTE) communities*

3.2 Faunal Species

Table 3-2 summarises the species or species groups for which the Site was found to support, or have the potential to support, which have been assessed as being of local importance or greater, and / or are legally protected. Table 3-2 also summarises potential significant effects upon these receptors (once embedded mitigation and good practice measures have been applied), along with potential effects which have licensing implications.

Table 3-2 Summary of Faunal Species / Species Groups of Local Importance or Greater (and / or Legally Protected), and Potential Significant Effects

Receptor	Evaluation	Potential significant effects
Terrestrial invertebrates	Local	Loss of 300.5 ha of locally important invertebrate habitat
Reptiles: common lizard *Zootoca vivipera*, slow worm *Anguis fragilis* and adder *Vipera berus*	Local	Loss of 293.1 ha of habitat suitable for reptiles
Otter *Lutra lutra*	Local	Loss of two couches (although not significant once best practice measures and licensing is applied)
Water vole *Arvicola amphibius*	Local	Displacement of small colony (although not significant once best practice measures and translocation under licence is applied)
Red squirrel *Sciurus vulgaris*	Less than local	No significant effects (small-scale habitat loss is non-significant)
Pine marten *Martes martes*	Less than local	No significant effects (small-scale habitat loss is non-significant)
Bats: common pipistrelle *Pipistrellus pipistrellus*; soprano pipistrelle *Pipistrellus pygmaeus*; brown long eared bat *Plecotus auritus* and *Myotis* sp	Local	Loss of one common pipistrelle day roost, and ten trees with Bat Roosting Potential (although not significant once best practice measures and licensing is applied)
Birds: 59 bird species, including black-throated diver *Gavia arctica*, red-throated diver *Gavia stellata*, black grouse *Lyrurus tetrix,* golden eagle *Aquila chrysaetos,* ring ouzel, snipe, teal and common sandpiper.	Local - international	No significant effects (once mitigation has been applied, including a golden eagle protection plan)
Fish: Arctic charr *Salvelinus alpinus*, brown trout *Salmo trutta* and Eurasian Minnow *Phoxinus phoxinus*	Local - national	Loss of access to spawning substrate for Arctic charr. Other residual effects are minor and non-significant.
Aquatic macroinvertebrate: *Psidium conventus*.	National	No significant effects (once mitigation has been applied)

3.3 Bog Restoration Areas

Information on the baseline survey of potential peatland restoration areas across the Ardverikie estate is provided in Appendix 8.6.1, and summarised in Section 5.3.1. The main Phase 1 habitat types recorded were wet modified bog and dry modified bog, with smaller areas of blanket bog, raised bog, basic flush, wet dwarf shrub heath and marsh / marshy grassland.

3.4 Woodland Restoration and Deer Control Areas

Detailed baseline field data have not been collected for the proposed woodland restoration and deer control areas across the wider Ardverikie estate, however an overview of broad habitats has been obtained based on review of aerial photography and desk-based data sources (Scotland Habitat and Land Cover Map LC88, and historical HIA data for Ardverikie, see Appendices A and B for further details). In summary, the areas are estimated to comprise approximately of:

- Deer exclosure (1,496 ha in total, 1,111 ha of which comprises retained terrestrial semi-natural habitat):
    - 17 ha blanket bog and peatlands;
    - 864 ha heathland;
    - 102 ha coarse grassland;
    - 42 ha broad-leaved woodland;
    - 81 ha coniferous plantation; and
    - 5 ha open canopy young plantation or woodland recently felled.
    - The remaining 385 ha relates to water (the existing Loch Earba), along with areas that will form the infrastructure footprint and inundation zone.
- Deer control area, outwith the deer exclosure (11,390 ha in total):
    - 2,328 ha blanket bog and peatlands;
    - 6,490 ha heathland;
    - 1,936 ha montane vegetation;
    - 301 ha cliffs;
    - 191 ha broadleaved, coniferous and mixed woodland;
    - 6 ha open canopy young woodland or woodland recently felled;
    - 120 ha water; and
    - 18 ha coarse and smooth grassland.

4.0 BEMP Working Group and Review

A group of key stakeholders in the BEMP would be invited to form a BEMP working group, their role would be to provide input into and comment on the detailed BEMP and subsequent revisions to the BEMP during the lifetime of the Proposed Development.

It is envisaged that the working group would include the following stakeholders:

- The Developer (Earba Ltd) and their ecological advisor(s);
- The landowner (Ardverikie Estate);
- THC;
- NatureScot; and
- SEPA.

Further details, including terms of reference for the BEMP working group, would be provided in the detailed BEMP, post consent.

The BEMP would be reviewed and updated on a regular basis, based on monitoring of progress toward achieving its goals and objectives and to inform active management. Proposed review timescales are set out in Table 7-1.

As the Developer, Earba Ltd is ultimately responsible for meeting the commitments made in this BEMP. The implementation of the final BEMP would be undertaken by suitably experienced contractors and all monitoring would be undertaken by suitably qualified and experienced environmental professionals.

5.0 Outline Biodiversity Enhancement and Management Plan

5.1 Scope and Vision

The geographical scope of the BEMP covers the Site and majority of the wider Ardverikie estate, as shown in Figure 8.6.1. A rationale for the extent and location of proposed BEMP areas is provided in Section 5.3.

The overall vision of the OBEMP is to enhance the extent and condition of target habitats within the proposed BEMP areas.

5.2 Targets

Table 5-1 details the species and habitats (features) that will be the targets of the BEMP, which will benefit from the management prescriptions. A rationale for their inclusion as targets is also provided. Associated objectives, outlined in Table 5-3 are included for reference.

The features which form the targets of this BEMP have been determined through consideration of the relative importance of ecological features present at the Site, the extent to which they may be affected by the Proposed Development (as set out in the EIA Report), their potential to benefit from restoration or management, local biodiversity priorities within the Highland Nature Biodiversity Action Plan[34], and national biodiversity priorities.

Table 5-1 BEMP Targets, Rationale and Management Prescription Outline

Management Prescriptions	Feature Benefitting	Rationale	Relevant Objectives (see Table 5-2)
Peatland restoration	Blanket bog / degraded blanket bog	Peatland is a general term for a wide range of peat soils and habitats that occupy more than 20% of Scotland's land area[35]. Scotland holds around 60% of the UK's peatlands soils[36]. Peatland has been identified as a national conservation priority within Scotland's National Peatland Plan (SNPP), for its importance for biodiversity, water quality, and as a carbon store. The most extensive and deepest peat soils occur under blanket bog and raised bogs. These habitats cover an area of around 1.9 million hectares in Scotland and are recognised as internationally important under the EU Habitats Directive (as Annex 1 habitats). Blanket bog is also listed on the Scottish Biodiversity List[37] and for Highland is subject to a Habitat Action Plan (HAP)[34] (as part of the Peatland and Wetland HAP). Restoration of	1.1

[34] Highland Nature Biodiversity Action Plan 2021 – 2026. Retrieved from https://www.highlandenvironmentforum.info/wp-content/uploads/2022/01/Highland-Nature-Biodiversity-Action-Plan-2021-2026-_compressed-.pdf [Accessed in December 2023]

[35] SNH (2015) *Scotland's National Peatland Plan: Working for our future*. [Online] Available at: https://www.nature.scot/doc/scotlands-national-peatland-plan-working-our-future [Accessed in November 2023]

[36] SEL (2009) Scottish Environment Link. *Peatlands Briefing May 2009*. [Online] Available at: http://www.scotlink.org/pdf/LINKPeatlandsBriefingMay09.pdf [Accessed November 2023]

[37] NatureScot (2023) *Scottish Biodiversity List SBL* [online] Retrieved from: https://www.nature.scot/doc/scottish-biodiversity-list [Accessed November 2023]

Management Prescriptions	Feature Benefitting	Rationale	Relevant Objectives (see Table 5-2)
		peatlands is also identified as a priority under NPF4, Policy 5. Blanket bog is therefore considered to be a priority habitat for conservation both nationally and locally, and forms a core part of the OBEMP proposals. Areas of blanket bog would be lost and degraded as a result of the Proposed Development, and as such, peatland restoration provides compensation. Peatland restoration works, particularly the creation of bog pools, is likely to benefit local priority[31] bird species including breeding dunlin *Calidris alpina*, golden plover *Pluvialis apricaria*, greenshank *Tringa nebularia*, snipe *Gallinago gallinago*, teal *Anas crecca* and mallard *Anas platyrhynchos*, and potentially common scoter *Melanitta nigra* and wigeon *Anas penelope*. It is also possible that crane *Grus grus* might use the area as a post-breeding dispersal site (if the Insh Marshes project becomes successful). Peatland restoration would also benefit invertebrates and amphibians.	
Woodland restoration / creation	Native woodland (conifer, mixed, broadleaf and riparian), montane willow scrub	A commitment to protect, regenerate and restore native woodland is contained within the Woodland and Forest HAP within the Highland Nature Biodiversity Action Plan[34]. The intention of NPF4 Policy 6 is to protect and expand forests, woodland and trees. Providing a large woodland restoration / creation scheme would provide compensation for the small-scale loss of woodland, and provide a significant enhancement. There is a requirement to provide compensatory woodland for any woodland lost, under the Scottish Government's Control of Woodland Removal Policy. Native woodland creation would increase breeding opportunities for local priority[34] bird species including tree pipit *Anthus trivialis*, spotted flycatcher *Muscicapa striata*, lesser redpoll *Acanthis cabaret* and mistle thrush *Turdus viscivorus*, and provide cuckoo *Cuculus canorus* and merlin *Falco columbarius* with more perching / lookout opportunities, as well as increasing the prey availability for hen harrier *Circus cyaneus*. Native woodland creation would also benefit invertebrates, red squirrel, pine marten and bats.	2.1, 3.1
Deer management	Upland and montane habitat assemblage: wet and dry heath, blanket bog, woodland, montane	Deer grazing can reduce the cover of dwarf shrub species through browsing, restrict growth of young trees through browsing and cause erosion in sensitive habitats such as blanket bog and montane habitats on thin soil or steep slopes through trampling. Current deer densities on the Ardverikie estate are approximately 13.2 per km^2 (refer to Appendix 8.6.2 for further details). Proposals involve removing deer from a 1,496 ha enclosure area, and reducing deer densities to	3.1, 4.1

Management Prescriptions	Feature Benefitting	Rationale	Relevant Objectives (see Table 5-2)
	heath, montane willow scrub, montane flush and spring communities, species-rich ledge communities, grasslands (acid / calcareous / marshy)	8 per km^2 across a 11,390 ha area, representing a 39% deer reduction. Reducing deer numbers and excluding areas from deer presents the most substantial, feasible, and location-appropriate opportunity for benefitting a wide range of high value and sensitive upland and montane habitats at a very large scale, including those habitat types that would be impacted by the Proposed Development. Reducing deer densities would also facilitate peatland restoration objectives.	
Watercourse and aquatic / riparian enhancement	Watercourse and aquatic / riparian zones, fish, aquatic invertebrates	Providing aquatic improvement works would provide mitigation and compensation for the loss and alteration of watercourses and aquatic habitat, which support Arctic charr, brown trout and a nationally important aquatic macroinvertebrate *Psidium conventus*. Management prescriptions such as the re-wetting of the Allt Labhrach, and improvement of fish spawning habitat quality, would benefit aquatic fauna.	5.1, 5.2, 5.3, 5.4, 5.5
Removal of Rhododendron	Invasive species	Rhododendron *Rhododendron ponticum* has been identified on the Site and wider estate. This invasive species is listed under Section 9 of the Wildlife and Countryside Act and can become dominant over large areas, eliminating the native flora. Control would prevent further encroachment into woodland and open upland habitats.	6.1
Control of bracken	Native woodland, heath, grassland	Bracken is present in one main area of the Site. Bracken can behave invasively, particularly where grazing has prevented heath and woodland habitats from regenerating. Where bracken is removed, the habitat has the potential to return to heath or regenerate to woodland habitats, particularly with the heath and woodland seed bank in surrounding areas.	7.1
Erection of 50 bat boxes	Bat species	Providing bat boxes would provide alternative roosting habitat to compensate for the loss of one bat roost and ten trees with bat roosting potential, as well as an enhanced roosting resource across the Site and wider estate.	10.1
Erection of 50 red squirrel and 30 pine marten boxes.	Red squirrel, pine marten	Providing nesting boxes would provide compensation for the small-scale habitat loss, as well as enhanced nesting opportunities across the Site and wider estate.	10.1
Provision of 10 reptile hibernacula, provision of log piles	Reptiles (common lizard, adder, slow-worm)	Providing reptile hibernacula and log piles would provide compensation for the loss of reptile habitat. These features would also benefit invertebrates.	11.1

Management Prescriptions	Feature Benefitting	Rationale	Relevant Objectives (see Table 5-2)
Diver rafts	Black-throated diver	Providing additional rafts on suitable lochs within the estate may encourage more breeding pairs to take up residence, creating an important local breeding population for this rare breeding species. Such provision would be carried out in consultation with the RSPB Diver Raft Programme.	12.1

It is acknowledged that THC's ornithology advisor raised the possibility of providing artificial raptor nests (peregrine and osprey). However, these have been excluded from the OBEMP targets, for the following reasons (provided by the project ornithological consultant):

- Artificial nests are usually used as a last resort in areas where nesting locations are thin on the ground, yet pairs of birds (or large accumulations of birds) are present, or in areas where nesting does not already occur (but probably should do). None of these criteria are met at Ardverikie.
- Peregrines have historically nested around Earba, and currently nest to the north of Laggan, and to the east within the estate boundary. Therefore, there appears to be a healthy local population, which suggests that the crags around Earba are not preferred by the birds.
- Ospreys are few and far between in the A82 corridor compared to Strathspey (and Lochaber), but a pair does nest just to the north of Earba in the Ardverikie woodland, so building another nest so close to an existing site is not practical, or beneficial for the birds, with limited foraging opportunities in the area.
- The time, effort and expense to create artificial nests that are ill-sited is not an optimal use of resources, and is unlikely to benefit any individual birds, or the local populations of those species, but (if encouraging another pair into an area does occur) may well disturb/displace them through unnatural competition over prey and unnatural territorial disputes.

Further discussion and consideration of this matter would be undertaken as part of the development of the detailed BEMP, post-consent, in consultation with RSPB and THC.

5.3 Rationale for the Extent and Location of Habitat Restoration and Management Proposals

The below sections detail the rationale for the extent of habitat restoration and management proposed for compensation and enhancement, and their locations. Justification for restoration approaches is also provided where relevant.

5.3.1 Bog Compensation

5.3.1.1 Bog Restoration

Blanket bog was found in both upland and montane (over 600m) areas of the Survey Area. The total area of bog habitat that would be directly and indirectly affected by the Proposed Development, including blanket bog, wet modified bog, dry modified bog and bare peat is 74.15 ha. Of this, 57.84 ha is montane, and 16.31 ha is non-montane. These loss calculations are based on the precautionary assumption that indirect loss of bog habitats

represents a permanent, irreversible negative effect, although in practice some areas indirectly affected may be able to be restored, e.g. during reinstatement following construction. It is also based on the assumption that bog habitats within 30m of infrastructure would be indirectly affected from drying effects, in accordance with NatureScot guidance[1], although this is also considered precautionary.

Current NatureScot guidance recommends a compensation ratio in the order of 1:10 in terms of blanket bog restoration, with additional restoration required for enhancement (in the region of an additional 10% of the baseline assessment of the extent of priority peatland habitat) to comply with the NPF4 guidance[1], although it is understood that the NatureScot guidance is likely to be revised in the near future[38].

Areas of blanket bog with potential for restoration within the wider Ardverikie Estate were investigated by Angus Davidson Ltd (ADL) for peatland restoration suitability (see Appendix 8.6.1).

The total area identified as having suitability for direct peatland restoration is c. 1,031 ha. This includes 978 ha that has been surveyed on the ground, and an additional 54 ha identified from aerial mapping that has yet to be surveyed on the ground. Of the areas ground-truthed, this is made up of Phase 1 habitat types blanket bog (12.3 ha), wet modified bog (527.2 ha), dry modified bog (432.8 ha), raised bog (1.6 ha), basic flush (1.6 ha), wet dwarf shrub heath (3.2 ha) and marsh / marshy grassland (0.2 ha), which are assessed as being in a fairly poor[39], degraded condition, primarily due to the presence of erosion features such as hags, ditches and gullies, along with moderate herbivore impacts in some instances.

Of the directly restorable peatland identified within Ardverikie Estate:

- 571 ha has been categorised as lying within Primary Restoration Zones (with vegetation resilient to the restoration process, good peat depths, soil generally able to bear the weight of excavators without resource to bog mats, presence of ancient forest tree roots to use in the restoration process, and easy access);
- 392 ha is in Secondary Restoration Zones (with variable vegetation condition, soils that may be more difficult to utilise tracked equipment over, poorer access, and less access to tree stumps for dams); and
- 68 ha is in Tertiary Restoration Zones (with more difficult access).

Of this, 423 ha of the directly restorable peatland is montane (above 600 m) and 608 ha is upland (below 600 m).

In addition to the areas detailed above identified as having direct restoration potential, it is estimated that a further 223 ha of primarily blanket bog units would indirectly benefit from the restoration (based on all identified suitable areas being restored), through improved habitat connectivity (see Appendix 8.6.1 and Map 10 therein for further details).

A total of around 625 ha of direct bog restoration would be undertaken. This figure has been derived to take into account comments from NatureScot's peatland advisor (see Table 1-1).

[38] As indicated at the Scottish Renewables Onshore Wind and Planning and Consents Forum on 2nd November 2023, where it was noted that the guidance was produced without consultation, and is proving to be unworkable for the renewable energy industry. It was also noted at the Forum that during a meeting of the Scottish Government's Peatland Advisory Group, on 31st October 2023, NatureScot accepted that the guidance should be revised.

[39] Condition Assessment used the condition assessment sheet for wetland, from Natural England Joint Publication JP039 Biodiversity Metric 4.0. Retrieved from https://publications.naturalengland.org.uk/publication/6049804846366720 [Accessed in September 2023].

The 625 ha of direct bog restoration would be undertaken within the 1,031 ha of suitable restoration areas identified by ADL (see Appendix 8.6.1 and Figure 8.6.1 for Primary, Secondary and Tertiary areas suitable for restoration).

It is proposed that the specific areas to be restored would be finalised at the detailed BEMP stage, informed by further survey work / analysis, and risk assessment (see Section 5.5.1 and Appendix 8.6.4).

Primary restoration areas would be prioritised, but the restoration would also aim to restore areas within hydrological units, where such suitable areas occur. In appropriate locations, restoration areas may include Secondary and Tertiary areas within the same hydrological units, where hydrologically appropriate, with such areas being risk assessed prior to work taking place. It may therefore be the case that some Secondary areas in key locations would be targeted in preference to small scattered areas of Primary restoration.

Further detail of the proposed approach with regard to restoring hydrological units is contained in Appendix 8.6.4. The bog restoration work would take a balanced view of the site, taking into account: time of year; current deer movements / hefts; future deer movements / hefts in response to the active management strategy; and general condition of the site. The restoration work would also be informed by an up-to-date Habitat Impact Assessment (HIA)[40] (see Sections 5.5.1 and 6.0 for further details on survey work and monitoring). Restoration works would be undertaken in a staged manner. A map is provided in Appendix 8.6.4 which shows potential restoration areas that would benefit directly and indirectly from restoration, along with watersheds. It is anticipated that restoration within Area A would initially be prioritised, with restoration within Area B, then Area C, prioritised next, in that order.

The restoration would also include the Secondary areas located immediately south-west of the Shuas dam, and in Coire Pitridh, where peat excavated from the dam can be used within the restoration process for environmental benefit (see Figure 8.6.1).

A larger area was initially considered for bog restoration, i.e. incorporating further Secondary and Tertiary Restoration Areas. However, proposals have since been revised to focus on peatland restoration that has the most robust deliverability and the highest chance of success, within the confines of the proposed approach to deer management (see Section 5.3.2.2 and Appendix 8.6.2 for details of proposed deer management).

Instead it is proposed that the 625 ha of bog restoration is paired with a substantial woodland and montane willow scrub restoration scheme, within a large c. 1,496 ha deer exclosure (of which c. 1,111 ha is retained terrestrial habitat), which would also benefit heathland and sensitive montane habitats (see Section 5.3.2.1). This proposal has the benefit of being easier to control, with greater certainty about the overall outcome, and it would diversify the outputs of the restoration. Appendix 8.6.2 provides further detail of the rationale of selecting this option.

The 1,031 ha of suitable bog restoration areas (Primary, Secondary and Tertiary), within which 625 ha of direct bog restoration would be undertaken, are illustrated in Figure 8.6.1. The total area of loss to direct restoration ratio is 1:8.4. Although it cannot be determined at this stage the precise proportion of montane and non-montane bog restoration that would be undertaken, montane areas would be prioritised where feasible, and it is estimated that a minimum of 250 ha of montane bog would be included in the overall bog restoration package.

[40] MacDonald, A., Stevens, P., Armstrong, H., Immirzi, P. and Reynolds, P. (1998) A guide to upland habitats surveying land management impacts ISBN 1 85 397 296 7

Some additional areas would also benefit indirectly from the restoration proposed, via improved habitat connectivity and being within the same hydrological unit (see Appendix 8.6.1 and Appendix 8.6.4).

It is acknowledged that this falls under the 1:10 compensation ratio recommended by NatureScot. NatureScot's guidance[1] advises that applications proposing less than the 1:10 restoration should provide justification, which is as follows.

The area of montane bog being affected by the scheme (around the margins of Loch Leamhain) comprises habitat on areas that lack very deep peat, much of which contains some erosion features of variable extent, and has a minor component of montane heath habitat within the mosaic. This area is not considered to have restoration potential due to the shallower nature of the peat, topography and nature of vegetation in this area.

Non-montane bog areas that would be affected by the scheme also tend to lack extensive areas of very deep peat, and vary in terms of the degree of erosion features. These factors contribute to a smaller baseline carbon store, in comparison to the larger relative carbon store of bog habitats on extensive very deep peat, where erosion features are absent.

Although the complete success of all restoration areas can never be guaranteed in any bog restoration scheme, the bog restoration areas proposed within this OBEMP incorporate areas that are deemed to have good deliverability and a high chance of restoration success, based upon survey data, recognised techniques, and the experience of the peatland restoration specialists (ADL, see Appendix 8.6.1).

The project proposes to divert resources away from additional bog restoration within the remaining potential restoration areas, and into measures with a much greater chance of success, specifically the proposed extensive woodland and other habitat restoration within the 1,496 ha deer exclosure (see Section 5.3.2), which would deliver a greater biodiversity benefit, and therefore more substantial enhancement, overall.

These above factors are all considered relevant when considering bog compensation requirements.

Overall, it is considered that the bog restoration proposals would provide adequate compensation for the loss of / impact to bog habitat as a whole (irrespective of altitude).

5.3.2 Non-Bog Terrestrial Habitat Compensation and Enhancement

The following sections describe the rationale for the areas and locations proposed to provide both habitat compensation, and significant enhancement, for a range of non-bog terrestrial habitats. The proposals incorporate a bespoke approach, where like-for-like compensation has not been provided for all habitat types (for example there is a heavier emphasis on native woodland restoration), but for which the overall package is considered to provide significant positive effects, which will offset the significant negative effects using a holistic approach, and provide significant enhancement.

5.3.2.1 Deer Exclusion: Native Woodland, Montane Willow Scrub, Heathland, Grassland and Montane Habitat Restoration

It is proposed that a large deer exclosure is created, extending beyond the Site boundary to the north and east, encompassing the mountains of Binnein Shuas, Binnein Shios, and Creag a Chuir, and extending northwards to the existing woodland along Loch Laggan (see Figure 8.6.1). The proposed exclosure also encompasses Loch Earba, and comprises a total area of c. 1,496 ha, of which c. 1,111 ha is retained terrestrial habitat beyond the scheme infrastructure and inundation footprint (the remainder of which is Loch Earba, and the infrastructure footprint and inundation zone). This large area has been selected for delivering habitat restoration, due to its potential to deliver significant native woodland restoration of

varying types at varying altitudes (with an existing seed source in some areas), as well as significant montane willow scrub restoration, along with a range of open habitats, such as heathland, peatland, and sensitive montane habitats, which should respond well to grazing being removed.

The proposed restoration would provide improved ecological connectivity, by incorporating and connecting up the most valuable area of woodland within the surrounding area (comprising Plantations on Ancient Woodland Sites (PAWS) along Loch Laggan), with the extensive woodland restoration proposals across the three mountains, including large areas of Scots pine *Pinus sylvestris* woodland (which would regenerate well if given the opportunity to do so by removing deer), thereby maximising the habitat connectivity and biodiversity value of the proposed restoration. It also provides an opportunity for effective and extensive restoration of montane habitat, across three mountain tops. Some smaller areas of tree planting are also proposed outwith the main exclosure (see Figure 8.6.1), encompassing a further 13 ha (further details are provided in Section 5.5.2).

In summary, the deer exclosure would aim to deliver:

- Enhancement of a total of c. 1,111 ha of retained terrestrial habitat via the exclusion of deer, natural regeneration, and targeted planting, further broken down into:
    - The restoration through removal of grazing of c. 65 ha of ancient woodlands, and a further c. 103 ha of Long Established Woodlands of Plantation Origin (LEPO);
    - Beyond this, a minimum c. 100 ha of native woodland natural regeneration;
    - The planting of c. 60 ha of birch / willow dominated woodland at conventional spacing;
    - The planting of c. 200 ha of low density native woodland on the intermediate slopes of Binnein Shuas and Binnein Shios;
    - The planting of c. 200 ha of low density montane willow scrub habitat across the three mountain tops. The exclusion of grazing within these montane areas would also be expected to enhance a range of other sensitive montane habitats where present within these montane zones, such as montane heath, species-rich ledges, scree and montane flush and spring communities; and
    - The additional planting of c. 68 ha of native woodland as screening / landscaping at key areas around the scheme infrastructure.

The remaining c. 328 ha comprises a range of open habitats such as peatlands, heathland and grasslands, that are also expected to benefit from the exclusion of grazing.

Further details on the rationale for this proposal are provided in Appendix 8.6.2 (where it is referred to as ‘Option B’). Appendix 8.6.2 also provides details of alternative proposals that have been considered, but which have been discounted. The measures presented within this OBEMP, are considered to:

- Represent the highest certainty of outcome;
- Represent the greatest biodiversity benefit with the greatest extent and diversity of habitat enhancement, including montane areas;
- Take into account consultee feedback to date;
- Retain Arverikie Estate’s heritage as a sporting estate whilst delivering habitat enhancement over the majority of the estate; and
- Be supported by Ardverikie Estate, the developer, and its specialist ecology advisers.

5.3.2.2 Deer Reductions: Bog and Heathland Restoration

Deer reductions across the majority of the remainder of the Ardverikie Estate (i.e. outwith the deer exclosures), totalling c. 11,390 ha, including all proposed bog restoration areas, would be undertaken. The purpose of maintaining lower deer numbers is to facilitate the delivery of successful bog restoration, and to benefit wider blanket bog and heathland habitats within this area.

The rationale for and details of proposed deer management are contained in Appendix 8.6.2, and summarised below.

Game records and information provided by Ardverikie Estate confirm that red deer *Cervus elaphus* is the main species present on the estate, but roe deer *Capreolus capreolus* and sika deer *Cervus nippon* are also present within woodland areas, where these species are controlled. Occasional wild boar *Sus scrofa* are also present in woodland areas.

Ardverikie Estate is part of the Mid-West Deer Management Group (MW DMG). Ardverikie Estate currently supports an average deer density of 13.2 deer per km^2, recorded during the last helicopter deer count undertaken for the MW DMG in 2021[41,42]. The average deer density across the full MW DMG area (which includes over 106,000 ha) has been decreasing overall, from 12 per km^2 (in 2006) to 8.4 per km^2 (in 2021)[43], although this varies across the MW DMG area, with deer numbers in the western sub area (west of the Site and Ardverikie estate) increasing over this period. Within Ardverikie Estate itself, higher deer densities are recorded within the eastern area of the estate, with lower densities recorded in the western area of the estate. The current MW DMG Deer Management Plan (2023 – 2028)[44] aims to maintain the 2021 total population within the eastern sub area of the MW DMG area as a whole (the eastern sub area includes Ardverikie Estate, along with Ben Alder, Corrour, Dunan and Cruach estates).

Deer densities within the eastern sub area vary, with densities within the Corrour Estate being much lower than other estates, due to un-fenced peatland and woodland regeneration conservation objectives. This difference in deer densities between neighbouring estates affects the deer dynamics of the overall MW DMG eastern sub area, with deer drifting towards the lower density areas on Corrour Estate, which is evidenced by cull data over the past two years. This provides context to understanding the deer dynamics within the MW DMG eastern sub area, and how this might relate to the proposed areas of peatland restoration within Ardverikie (a more detailed description is provided in Appendix 8.6.2).

It is proposed that the average deer density across the c. 11,390 ha area of the estate (shown as the 'Deer Control Area' in Figure 8.6.1) is reduced to 8 deer per km^2, and maintained at that level. This represents a 39% reduction in deer numbers within this area compared to baseline levels. This is considered to represent a suitable deer density that is compatible with a successful outcome of proposed bog restoration areas, while still retaining some of the deer stalking history and culture of the estate. A summary of the basis of this conclusion is provided below (with a more detailed rationale provided in Appendix 8.6.2):

[41] Irvine, J. (2021) Deer Count Report. Mid West Association Deer Management Group. NatureScot.

[42] It should be noted that the NatureScot helicopter count of the MW DMG area in 2021 has mistakenly shown the area counted on Ardverikie to be 16,590 ha, giving an overall deer density of 10 deer per km^2. However, Ardverikie estate have clarified the hill area counted in 2021 is 12,990 ha, which includes any accessible woodland areas. This corrected figure gives an overall deer density at Ardverikie of 13.2 deer per km^2.

[43] Corrected from the 7.9 deer per km^2 quoted within the MW DMG Deer Management Plan, which was based on an incorrect figure used in the NatureScot 2021 helicopter count.

[44] https://midwestassociationdmg.deer-management.co.uk/deer-management-plan/ [Accessed in January 2024]

- A NatureScot document[45] states that "*Scottish Natural Heritage should adopt 10 red deer per square kilometre as an upper limit for acceptable densities of red deer over large areas of open range in the Highlands*", although NatureScot's deer advisor has clarified that this has only been adopted as an upper benchmark to help focus priorities, recognising that densities below this target are needed to achieve woodland, peatland and other objectives. The Farming Advisory Service recommends that 10 red deer per km^2 would result in "*low to moderate negative impact on upland vegetation*"[46]. The Farming Advisory Service[47] and Putman *et al.* (2011)[48] further specify that more than 8 red deer per km^2 is likely to be damaging to peatland habitats. NatureScot advise that densities of < 3-5 deer per km^2 may be appropriate for blanket bog sites[49].
- Deer densities to deliver successful bog restoration will vary according to: site location in relation to other habitats; altitude; restoration techniques used; and the extent of peatland within the landscape. While a range of informed opinion has been sought, what is actually required is subjective and difficult to predict with certainty. Therefore, the proposals presented here include a mechanism for adjustments to deer management, based upon ongoing monitoring.
- In the experience of the project woodland and deer specialist, Victor Clements, based on 10-12 different deer management groups who undertaken habitat monitoring, appropriate densities depend very much upon the extent of blanket bog within a landscape. Where blanket bog dominates a landscape, deer densities tend to be very low due to the nutrient poor status of blanket bog habitat, with a low carrying capacity. Where blanket bog extends over a smaller proportion of the landscape, it tends to be other vegetation types that set the carrying capacity, and deer tend to preferentially graze on these because of their higher nutrient status, and not the blanket bog areas. It is therefore possible to have relatively high deer densities but have little impact on blanket bog, but this depends to a large extent on the position of blanket bog areas. The Ardverikie Estate falls into this category, with approximately 20 % blanket bog / peatland present. This means that c. 80% of the estate comprises better quality vegetation and deer are more likely to graze this, although a proportion of this will be montane vegetation which cannot sustain much grazing. However, deer moving across an area of blanket bog can cause tracking impacts. It tends to be movement that causes impacts, not grazing pressure as such. At higher densities, many peatland areas can avoid trampling impacts simply due to their location in relation to other habitats, but in some locations they will be very vulnerable.
- The above information would suggest that the existing deer densities at Ardverikie could be damaging to some peatland / blanket bog sites. However, existing habitat data suggests that this may not be the case. Specifically, a HIA report for Ben Alder

[45] NatureScot (2020) The management of wild deer in Scotland: Deer Working Group report. (https://www.gov.scot/publications/management-wild-deer-scotland/pages/35/)

[46] Farming Advisory Service (2017) Conservation Grazing for Semi-Natural Habitats.

[47] Farming Advisory Service (2021) Managing Peatland and Upland Habitats

[48] Putman et al. (2011) Identifying threshold densities for wild deer in the UK above which negative impacts may occur. Mammal Review

[49] Scottish Natural Heritage (2016) Planning for development: What to consider and include in deer assessments and management at development sites. Version 2. March 2016.

and Aonach Beag SAC, commissioned by NatureScot in 2021[50], which focussed on wet heath and blanket bog habitats, showed low or moderate-low herbivore impacts for most plots surveyed. Additionally, routine blanket bog HIA monitoring across the Ardverikie Estate, which has been carried out since 2018, has found almost all herbivore impacts in that period to be low. The ADL peatland report (see Appendix 8.6.1) details that most of the deer impacts noted across the areas for potential restoration were largely low or moderate.

- It is likely that peatland at higher levels will be more impacted by deer during the summer months, when deer drift towards the higher tops. Average deer densities in the summer months may well be less than the 13.2 per km^2 counted in spring 2021.
- Overall, the evidence suggests that relatively high deer densities at Ardverikie do not appear to be causing significant impacts to blanket bog habitat, and that the current deer densities are broadly compatible with peatland habitats on Ardverikie. However, any restoration process will disturb the surface of the peat bog, which will take time to consolidate and bed in. Similarly, any areas of bare peat that are revegetated will be vulnerable for a number of years, until the new growth is relatively strong. Such areas are likely to be more attractive to deer than areas with more rank vegetation. As such, restoration areas will initially be more vulnerable to herbivore impacts, for a number of years.
- Primary bog restoration areas are being prioritised, and it is assumed that these can withstand a higher deer density than areas of Secondary and Tertiary restoration, although it is noted that some Secondary or Tertiary areas may be deemed to have higher priority than Primary areas in some areas, in order to prioritise the restoration of hydrological units, subject to risk assessment. It is also noted that some of the restoration is at higher altitudes, and hence more vulnerable. A suitable deer density buffer should be given, to provide confidence that the restoration will be successful. Based on the above information and professional judgement, the view of the project woodland and deer specialist is that reducing the deer density to 8 per km^2 would allow the Primary areas of restoration to succeed, hopefully with a buffer built in.
- Leaving a viable deer herd is part of the overall balance being sought by all parties. Ardverikie Estate have made clear that while they are prepared to implement a very significant reduction cull to facilitate peatland restoration and other habitat enhancement (as proposed within this OBEMP), they do not wish to see deer reduced to extremely low numbers.

In addition to facilitating the 625 ha of proposed blanket bog restoration, the reduction of deer numbers by 39% also targets benefitting other upland habitat types within this 11,390 ha area, most notably heathland, along with further blanket bog areas beyond the 625 ha identified for restoration. Specifically, this area is estimated to support c. 6,490 ha of heathland, and 1,705 ha of blanket bog and peatlands (beyond the 625 ha identified for further bog restoration techniques)[51]. By extrapolating from detailed baseline habitat data collected within the Site by Tracks Ecology, it is estimated that the majority of the heathland within this area comprises wet dwarf shrub heath.

The remaining areas are estimated to be made up of broadleaved woodland; cliffs; coarse grassland; coniferous plantation; mixed woodland; montane vegetation; open canopy young plantation; smooth grassland; water and woodland recently felled.

[50] Wells, C. (2021) Repeat Assessment of Herbivore Impacts at the Ben Alder and Aonach Beag SAC. Draft Report.

[51] Estimates of habitat cover are based on Land Cover Scotland LCS 88 database

A reduction in deer density of 39% has the potential to result in conservation benefits at an almost estate-wide scale.

The proposed deer density does not target enhancing habitats that are more highly sensitive to grazing (such as native woodland, siliceous scree, upland tall herb communities and montane willow scrub[52]), for which enhancement is instead focussed within the deer exclosure area (refer to Section 5.3.2.1).

5.3.2.3 Rhododendron and Bracken Control

Rhododendron control and bracken control areas (see Figure 8.6.1) represent those areas within the Site and wider estate that are known to support such species, and for which semi-natural habitats would benefit from their removal.

5.3.2.4 Further Rationale for Compensation and Enhancement Areas for Specific Habitat Types

The Proposed Development would result in the direct permanent loss, and the indirect / temporary loss, of 340 ha of non-bog terrestrial habitats.

Restoration of c. 1,111 ha of habitats within the exclosure as detailed in Section 5.3.2.1, along with the reduction of deer densities by 39% across the majority of the remainder of Ardverikie Estate (c. 11,390 ha, see Section 5.3.2.2), and Rhododendron and bracken control (see Section 5.3.2.3) would provide holistic compensation for the loss of, and impact to, non-bog terrestrial habitats (see Section 5.3.2 and below for bog compensation details), as well as a significant enhancement. This conclusion is based on the overall scale over which habitat restoration and management measures are proposed, as well as the diversity and high value of habitat types being restored and positively managed.

Overall, a total of c. 11,876 ha of terrestrial habitat (excluding bog restoration) is being restored, created or positively managed, which represents an area approximately 35 times the size of (non-bog) terrestrial habitat being directly lost or temporarily / indirectly affected by the scheme.

When considering all terrestrial habitat together (including bog habitats), the area of habitat that is being restored / created / positively managed (12,501 ha) is approximately 30 times the size of all terrestrial habitats being directly lost or temporarily / indirectly affected by the scheme (414 ha).

Further rationale for compensation and enhancement areas for the main habitat types being significantly affected is provided in the following sections.

Native Woodland

The majority of the semi-natural woodlands that would be lost to the proposed development are native conifer (Scots Pine) woodland (5.48 ha), with some mixed and broadleaf woodland also lost (2.13 ha), and a small amount of coniferous plantation (0.05 ha), totalling 7.66 ha of woodland loss overall.

A 5.35 ha strip of habitat mapped on the Ancient Woodland Inventory (AWI), located on the shores of Loch Earba, would also be lost. However, this area was found to comprise primarily grassy and heathy vegetation, with sparse scattered trees, which are remnants of ancient woodland, in poor condition. THC's forestry officer has advised (email dated 11.12.23) that although the area recorded in the AWI includes remnants of ancient

[52] Holland, J.P., Pollock, M., Waterhouse, T., Morgan-Davies, C., Bibby, H., Stewart, S. and Armstrong, H.M. (2010). Scottish Natural Heritage Commissioned Report No.402.

woodland, it is in poor condition judging by the baseline survey information supplied, and that given the poor condition it would not be reasonable to try to safeguard it.

A compensation ratio of at least 1:1 in terms of woodland lost to woodland created is required to comply with the Scottish Government's Control of Woodland Removal Policy (CoWRP). Targets for native woodland creation in the Cairngorms set out by the Scottish Government look to expand woodlands by 12,000 ha per year.

The areas proposed for native woodland restoration and creation totals approximately 596 ha (excluding montane woodland / scrub, which is discussed separately on the following page under 'Montane Willow Scrub and Other Sensitive Montane Habitats'), which is a ratio of 1:78 of woodland lost to woodland restored / created.

An earlier overview draft of the proposals, which was shared with NatureScot and THC for comment to guide development of the proposals, contained c. 68 ha of native woodland creation. THC's forestry officer confirmed that this would be accepted as sufficient compensatory woodland planting for the loss of woodland under NPF4 Policy 6bii. As such, the additional expanded woodland scheme in these final proposals is considered to provide a very significant enhancement, beyond minimum compensation requirements. The native woodland scheme is also considered to provide compensation for the loss of other non-woodland habitats.

In addition to compensating for the small-scale loss of woodland habitat, woodland creation would increase connectivity of native upland woodland habitat in the area, increase habitat for woodland birds and mammals, and provide services such as erosion control in the upland habitats. Riparian woodland in riparian zones can provide habitat for fish, aquatic invertebrates and otter, and increase aquatic invertebrate population density and species diversity, provide shaded areas for fish and reduce bank erosion.

Heathland

The proposed development would result in the direct permanent loss of 124.7 ha of wet dwarf shrub heath, and 8.0 ha of dry dwarf shrub heath. A further 56.1 ha of dwarf shrub heath would be temporarily or indirectly affected, although much of this would be reinstated following construction (see Section 5.5.8).

The proposed deer exclosure would restore c. 328 ha of open habitats via the exclusion of grazing, the majority of which is estimated to comprise heathland (based on a combination of Phase 1 / NVC survey undertaken by Tracks Ecology, Land Cover Scotland LC88 data, and review of aerial imagery).

Further to this, an estimated 6,490 ha of heathland (based on Land Cover Scotland LC88 data) occurs within the wider deer control area, outside of the deer exclosure, and these heathland areas are also expected to benefit from the proposed 39% reduction in deer density. It is estimated that these heathland habitats across the wider estate are dominated by wet dwarf shrub heath, based on an extrapolation of Site knowledge.

This equates to an estimate of heathland areas to be restored or positively managed that is approximately 36 times the size of heathland habitat to be affected by the scheme[53]. This is considered to provide compensation, as well as a significant enhancement.

[53]An area of heathland restoration that is larger than the area of heathland that is lost is required to provide adequate compensation.

Montane Willow Scrub and Other Sensitive Montane Habitats

The proposed development would result in the loss of up to four discrete patches of montane willow scrub (too small to map), as well as small-scale loss of other more restricted sensitive montane habitats. Of significance, this relates to montane heath / dwarf herb (1.27 ha), upland species-rich ledges (too small to map) and flush and spring habitats (1.02 ha).

An area of c. 200 ha of montane habitat would be restored within the proposed deer exclosure area, on the mountain tops of Binnein Shuas, Binnein Shios, and Creag a Chuir. Within these areas, montane willow scrub restoration is targeted, however the range of other existing montane habitats within these areas would also benefit from the removal of grazing. These areas have not been subject to detailed habitat survey, which would be undertaken as part of the development and implementation of the detailed BEMP post-consent. However, it is expected that a range of the more restricted and sensitive montane habitats would be present within these areas, and the proposed management would therefore provide compensation for loss of these montane habitat types. In the case of mountain willow scrub, the proposals would also provide an enhancement, given the scale over which such restoration is proposed.

5.3.3 Aquatic Compensation

The Allt Labhrach, which joins Loch Earba with Loch Laggan, is currently depleted due to existing hydro development, and it receives no hands-off flow. This watercourse would be restored and enhanced via rewetting, along its c. 2.2 km stretch. This would provide some compensation for the loss or alteration of c. 2.69 km of watercourses as a result of the Proposed Development (due to infrastructure or altered hydrological regimes). Although this is a SEPA requirement, it is still considered to represent additionality, as it would not occur but for the Proposed Development.

The instalment of ‘large woody structures’ in littoral zone areas would encourage and improve macroinvertebrate habitats.

Improvement of brown trout and Arctic charr spawning habitat quality and accessibility on a c. 0.7 km stretch of the Moy Burn (or similar alternative habitat spawning provision), would aid in mitigating spawning losses as a result of the proposed development, and enhance current conditions within the burn. Provision of marginal loch spawning habitat via the creation of terraced ‘pools’ within Loch Earba would also provide some mitigation for the impacts upon aquatic habitat, Arctic charr and brown trout, and would maintain macrophyte and macroinvertebrate habitat opportunities. The provision of artificial floating spawning nests for Arctic charr within Loch Leamhain and Loch Earba would provide mitigation for lost spawning habitat within Loch Leamhain.

Riparian planting (c. 20.9 ha) detailed in Section 5.3.2.1 would also enhance the riparian zone and benefit aquatic fauna.

5.4 Goals and Objectives

The proposed goals and objectives of the BEMP are set out in Table 5-3.

Timescales and indicators are covered in more detail in Section 6.0 and Table 7-1.

Table 5-2 Proposed BEMP Goals and Objectives

Goal	Objective	Targets	Quantity	Location (see Figure 8.6.1)	Timescales	Indicators
1. Bog restoration	1.1 Undertake bog restoration to restore degraded / modified bog	Blanket bog / degraded blanket bog	625 ha	Bog Restoration Areas across Ardverikie Estate	Implementation to commence during construction period, with capital restoration works to be undertaken over 3-5 years.	Bog habitat condition. Water table raised.
2. Woodland restoration	2.1 Restore and create native woodland to enhance biodiversity connectivity, via a 1,496 ha deer exclosure and targeted planting.	Semi-natural woodland (conifer, mixed, broadleaf and riparian)	Areas targeted within deer exclosure: - restoration of c. 168 ha ancient woodlands / LEPO - c. 100 ha native woodland regeneration - c. 260 ha native woodland planting - c. 68 ha upland / riparian native planting, for landscaping	Within deer exclosure on Binnein Shuas, Binnein Shios, and Creag a Chuir.	Fencing to be erected at the start of construction, with targeted planting completed during construction period.	Extent of woodland cover (natural regeneration and tree survival). Habitat condition.
3. Restoration of montane willow scrub and other montane habitat	3.1 Restore montane willow scrub and other montane habitat, via a 1,496 ha deer exclosure and targeted planting	Montane willow scrub, montane heath, montane flush and spring communities, species-rich ledge communities	c. 200 ha targeted within deer exclosure	Within deer exclosure on Binnein Shuas, Binnein Shios, and Creag a Chuir.	Fencing to be erected at the start of construction, with targeted planting completed during construction period.	Habitat condition and cover. Extent of willow scrub cover and survival.

Goal	Objective	Targets	Quantity	Location (see Figure 8.6.1)	Timescales	Indicators
4. Enhancement of heathland and other upland habitats	4.1 Reduce deer numbers by 39% (8 deer per km^2) outwith the deer exclosure, to provide benefits to upland habitats including heathland, and facilitate bog restoration	Wet dwarf shrub heath, dry dwarf shrub heath, grasslands, blanket bog	Deer reductions across c. 11,390 ha deer control area, of which an estimated 6,490 ha is heathland. A further c. 328 ha of open upland habitats would also benefit from grazing exclusion within the deer exclosure area.	Within deer control area.	Reduction culling to commence prior to / at the start of construction, to be undertaken over four years to reach target density. Target density maintained thereafter.	HIA. Deer count.
5. Watercourse and aquatic / riparian enhancement	5.1 Enhance the Allt Labhrach by re-wetting	Watercourse and aquatic zone, fish, aquatic invertebrates	c. 2.2 km	Allt Labhrach	Immediately following construction.	Watercourse condition.
	5.2 Create riparian woodland	Riparian zone, fish	20.9 ha	Moy burn and inundation margins	Immediately following construction.	Extent of tree cover (tree survival) and habitat condition.
	5.3 Enhance spawning habitat on Moy Burn	Watercourse, fish	c. 0.7 km	Moy burn	During construction period.	Fish monitoring.
	5.4 Install large woody structures in littoral zones	Aquatic invertebrates, fish	Waterbodies across Ardverikie Estate not affected by water level changes (location and quantity to be confirmed).		During construction period.	N/A
	5.5 Install artificial floating spawning nests	Arctic charr	To be confirmed	Loch Leamhain and Loch Earba	Immediately following construction (Loch Leamhain), before /	Fish monitoring.

Goal	Objective	Targets	Quantity	Location (see Figure 8.6.1)	Timescales	Indicators
					during construction (Loch Earba).	
6. Remove invasive species	6.1 Removal of all identified Rhododendron	Rhododendron	See Figure 8.6.1	See Figure 8.6.1	Implementation within construction period.	Absence of Rhododendron.
7. Control bracken	7.1 Control bracken	Native woodland, heathland, grassland	10.6 ha	North of Loch Earba, within deer exclosure	Implementation within construction period.	Extent of cover.
8. Reinstate habitats disturbed during construction	8.1 Reinstate habitats temporarily disturbed during construction within the working corridor.	A range of upland habitats.	c. 91 ha	Working corridor surrounding infrastructure footprint	Implementation within 2 years of completion of construction	Habitat condition.
9. Translocate sensitive plant species	9.1 Translocate sensitive plant species during construction	Downy willow, field gentian, petty whin, hawkweed sp.	At 9 locations identified within baseline survey		Translocate prior to / during construction	Plant survival.
10. Enhance nesting / roosting habitat for mammal species	10.1 Erect bat boxes, red squirrel boxes and pine marten boxes	Bats, red squirrel, pine marten	50 bat boxes, 50 red squirrel boxes, 30 pine marten boxes	Retained woodland	Install during construction period	N/A
11. Enhance reptile habitat	11.1 Create reptile hibernacula and log piles	Reptiles (common lizard, adder, slow-worm)	10 reptile hibernacula, number of log piles to be confirmed	Retained heathland and woodland edges	Install during construction period	N/A
12. Enhance habitat for divers	12.1 Provide nesting platforms for divers on appropriate lochans	Black-throated diver	Location and quantity to be confirmed by monitoring.		Implementation within 5 years of completion of construction.	N/A

5.5 Outline Habitat Creation / Restoration Methods

All management tasks carried out under the BEMP would be undertaken by suitably experienced contractors, under the supervision (where required) of suitably qualified and experienced environmental professionals, and specialist restoration practitioners where relevant.

5.5.1 Bog Restoration (Objective 1.1)

Bog restoration would be undertaken by appropriately experienced and qualified peatland restoration contractors.

Areas suitable for restoration, within which 625 ha of direct bog restoration would be undertaken, are shown in Figure 8.6.1. The proposed restoration methods are based on published literature and established restoration methods[54].

The methods set out below are a high-level overview of the approach to be taken. This will be discussed with key stakeholders, including NatureScot and the chosen contractor, and the agreed approach and finalised locations will be set out in detail in the detailed BEMP post consent. The restoration areas would require a range of tailored approaches, which would be developed at the detailed BEMP / implementation stage (post consent), informed by further detailed survey work and consideration of restoration techniques available at the time of implementation.

For all proposed Bog Restoration Areas, the following preparation work is proposed:

1) A peat depth survey and Peat Slide Risk Assessment of Bog Restoration Areas would be undertaken.

2) A botanical monitoring survey would be undertaken to establish an up-to-date baseline for the vegetation types present. The botanical survey, including HIA, paired with drone monitoring or other aerial photography, would then be used as a baseline for ongoing monitoring (see Section 6.1 for further details). Baseline botanical monitoring would be undertaken at an appropriate time of year, prior to restoration works.

3) A drain slope survey and mapping exercise would be undertaken across all Bog Restoration Areas, prior to restoration works, including hags and gullies. Taking levels of the drain water surface would allow for the creation of drain slope profiles across the restoration areas. In general terms, the aim would be to insert a dam for each 10cm drop in level of each drain / gully – this is intended to ensure that the water level across each restoration area is maintained within 10cm of the bog surface to allow for the growth of peat-forming plants. Analysis and mapping from drone orthomapping would also be undertaken, to derive the lengths of restoration (drains / gullies / hags), the extent and location of bare areas, and herbivore tracking.

4) A Construction, Environmental Management Plan (CEMP) for restoration works would be produced prior to the commencement of works.

The primary techniques that are likely to be used within the proposed restoration areas include (see Appendix 8.6.1 for further details):

[54] NatureScot (2022) *Peatland ACTION – Technical Compendium*. Retrieved from: https://www.nature.scot/doc/peatland-action-technical-compendium [Accessed in December 2023]

- Reprofiling. This is the technique likely to be most frequently used for hag and gully restoration. Reprofiling would most likely involve the reprofiling of peat hags and other eroded banks to create a stable slope angle of approximately 30º, by rolling back the vegetation on the top of the hag, removing the underlying peat to create a stable sloping bank, and then rolling the vegetation back on and compacting to cover the newly profiled slope. For smaller hags, this is all that is likely to be required. In the case of larger hags, additional techniques may also be required, which would potentially involve re-vegetation of bare peat and further actions to provide sufficient stabilisation (see below).
- Bare area coverage and gully restoration. Flow management may be required initially in gully systems and peat pans, to slow the flow of water down. In gullies that have eroded to the mineral layer, stone dams or other specialist solutions may be required, depending on whether there is sufficient peat at the base of gullies. Surface bunds can be used in gullies, using materials such as peat turves, coir logs, wood, peat filled geo-textile sacks, heather bales or mineral. Following flow management, where required, stabilisation and revegetation would then be undertaken. Reprofiling of any gully or peat banks would be undertaken as described above for hag reprofiling. Where reprofiling is not possible, or there are large areas to cover, re-vegetation techniques may be required. This may involve the placing of textiles (such as coco mesh, sisal netting or geo-jute) over brash. Whole turving can also be undertaken to re-vegetate areas of bare peat, by covering with turves from donor sites. Transplanting plugs or propagules, or adding *Sphagnum* fragments onto, bare peat to encourage revegetation on bare peat, can also be considered.
- Any smaller drains / ditches present would be blocked with dams (such as using stone, wood, vegetation, and stumps). Wallage (2007)[55] found that drain blocking can be highly effective for improving both carbon storage and upland water quality. Peat excavated from construction activities can be used to block the drains in the peat restoration area close to the Shuas dam, subject to suitability / feasibility. Dam location and frequency would be informed by drone orthomapping analysis and drain slope survey results, to inform the preparation of the detailed BEMP post consent.

These works would be undertaken outwith the breeding bird season, or if this is not practical following checks for breeding birds to allow mitigation to avoid disturbance to sensitive species and / or damage to active nests.

Herbivore impacts at proposed restoration areas would be managed via deer reduction culling, reducing deer densities to 8 per km^2, as detailed in Section 5.3.2.2 and Appendix 8.6.2.

For the smaller areas of Secondary Bog Restoration Areas close to the Shuas dam and Coire Pitridh area (see Figure 8.6.1), restoration works would initially be protected from deer trampling by an electric fence. Additional available areas of Secondary Bog Restoration within this area would also be considered, if any areas elsewhere are found to be technically difficult, thereby allowing for some flexibility, and ensuring 625 ha are successfully restored overall.

Bog restoration works would be undertaken in a staged manner, broken up into smaller areas, over 3 – 5 years.

Control plots of good condition blanket bog that the habitats within the peatland restoration areas could reasonably be expected to revert to following restoration works should be

[55] Wallage, Z. (2007) *Dissolved organic carbon and colour dynamics in drained and restored blanket peat*. PhD thesis, University of Leeds.

identified within Ardverikie Estate and monitored to aid in monitoring peatland restoration success and the setting of site-specific vegetation targets for bog habitats (e.g. % cover of *Sphagnum* etc.), along with identifying any possible changes in condition due to external factors.

5.5.2 Deer Exclosure: Woodland and Montane Habitat Restoration / Creation (Objectives 2.1, 3.1, 5.2)

A deer exclosure totalling 1,496 ha, of which 1,111 ha is non-inundated retained semi-natural habitat beyond the infrastructure footprint, is proposed. This would encompass the mountains of Binnein Shuas, Binnein Shios, and Creag a Chuir, and would also enclose Loch Earba.

The approximate location of the proposed deer fence line is shown in Figure 8.6.1 (and Appendix 3.6.2, 'Option B'). The precise route of the fence line would be subject to a fencing contractor walkover, as part of development of the detailed BEMP, post-consent. The proposed fencing configuration takes into consideration black grouse lek locations, and minimisation of impact to the landscape as far as possible (including climbers accessing Ardverikie Wall).

The deer fencing would be erected at the start of construction, to facilitate tree planting and regeneration at as early a stage as possible. Some temporary fencing may be required at certain sections whilst construction works are ongoing, to exclude deer, where the final proposed fence line is within the working corridor.

An outline of proposed woodland zoning is provided below (see also Appendix 3.6.2). More detailed woodland zoning and planting proposals would be developed as part of the detailed BEMP, post-consent, which would be informed by ground survey. The detailed woodland scheme would be developed, and implementation overseen, by an experienced woodland specialist. The development of detailed mountain willow scrub proposals would be undertaken by a woodland specialist who specialises in montane woodland.

Outline prescriptions within each proposed woodland zoning area are summarised below.

1. Restoration of c. 65 ha of ancient woodlands and c. 103 ha of LEPO.

The existing ancient woodland is primarily birch dominated. Enclosure of this area would allow for improved establishment of ancient woodland ground flora, and potentially a shrub layer if a seed source is present.

The areas of LEPO woodland support trees dating from 1920 or 1930, with one sub area dating from 1950, and were historically part of a larger woodland planting area. The trees are mostly Scots pine, with a proportion of native broadleaves. Three small sub compartments comprise mixed conifers. Estate records note that Scots pine seed was collected from old growth forest on "east Binion" in the 1870's, to produce seedlings in their own nursery, so it appears that these trees are from genuine local provenance, collected from one of the hills themselves. These woods are planted, but they have been in the landscape for a century and the wider area for longer. They comprise almost entirely native species, and could be used to create pinewood regeneration both down to the loch, and also up to a significant altitude on both sides. Enclosing these areas would allow development of suppressed woodland vegetation, presuming that this exists at least to some extent, it would allow regeneration within the woodland area, some of which is relatively open, and these trees would be the seed source for pinewood extension on to adjacent ground.

As such, no specific management action is proposed within these areas, beyond enclosing them, as it is expected that natural regeneration would occur.

2. A minimum c. 100 ha of native woodland natural regeneration.

It is expected that an expansion of existing native woodland would occur, via natural regeneration, due to the existing seed source from the adjacent ancient woodland and Scots pine trees. A conservative estimate is that natural regeneration would occur over c. 100 ha, although some could extend beyond this.

As such, no specific management action is proposed within these areas, beyond enclosing them, as it is expected that natural regeneration would occur. However, in the instance that monitoring shows that natural regeneration is not occurring as expected, additional targeted planting would also be undertaken.

3. Planting of c. 60 ha of birch / willow dominated woodland at conventional spacing (Zone 1).

Planting would be undertaken in areas where an existing seed source is not present, and therefore where natural regeneration is unlikely to occur. The priority for these areas is to create woodland cover quickly, and provide a seed source which would then provide for subsequent regeneration within the wider area.

Planting at a spacing of 1,100 trees per ha (3 m average spacing) using mounding and planting would be undertaken in the area to the west of Binnein Shuas and west of Binnein Shios (c. 60 ha), where easy access by conventional machinery is possible, and soils are suitable. Areas of wetland, peatland and other carbon rich soils within these areas (approximately 60 ha) would not be planted, such that the overall woodland is open, covering approximately 50% of the ground, and avoiding sensitive habitats. A planting mix of downy birch *Betula pubescens*, rowan *Sorbus aucuparia* and mixed willows *Salix* spp. is proposed within the c. 60 ha area, with 5-10% Scots pine also incorporated. The spacing will allow the trees to grow fuller crowns, that will increase their ability to produce seed in the longer term.

4. Planting of c. 200 ha of low density native woodland on the intermediate slopes of Binnein Shuas and Binnein Shios (Zone 2).

Planting within this zone, concentrated mostly on Binnein Shuas, and a lesser area on Binnein Shios, would be undertaken at a reduced density, up to the 500m altitude level. This area is not accessible by machinery, and therefore trees would be hand screefed. A planting mix of downy birch, rowan, mixed willows and Scots pine is also proposed in this area. The target density is 500 trees per ha, but 625 trees per ha would be planted, to aim to avoid the need for subsequent beating up.

Sensitive habitats are less likely to be found within this zone, with planting niches constrained mainly by areas of rock and very thin soils. It is unlikely that this could be mapped in detail. Planters would therefore select planting areas, retaining the 3 m planting distance, but only covering c. 40% of the area, in groups of c. 20-50 trees, in the most appropriate areas. There would be a strong emphasis on individual planting choices and overall supervision. This would create woodland that is as random as possible, while choosing the better micro-sites. Such trees may need to be fertilised.

5. Planting of c. 200 ha of low density montane willow scrub habitat across the three mountain tops (Zone 3).

At the three mountain tops, above 500m, low density montane willow scrub planting is proposed. It is very likely that a small proportion of native species already exists in these areas, and a planting prescription would boost the numbers of these.

At this altitude, a significant proportion of the area will not be possible to plant, either because of rock, very shallow soils, or where the terrain is too difficult or dangerous to access. Therefore it is proposed that the planting density is reduced to 200 trees per ha, to comprise entirely montane willow species, and possibly a small proportion of juniper.

The trees would be hand planted, planted in groups of 10-20 at 3 m spacing, covering 20 percent of the area. Planter initiative would be required, with supervision of a very high standard. The slightly lower altitude starting point of 500 m will allow montane species to grow more quickly and give faster impact.

For Binnein Shios and Creag a Chuir, it is very likely that any montane planting would be supplemented by regeneration from below, likely including some Scots pine at these higher elevations. All such regeneration would be accepted, and is expected to lead to a natural and diverse mix of tree and shrub species.

Planting montane willows is a specialist undertaking, and specialist advice would be sought from an early stage. Sourcing suitable seedlings may also be more difficult than the other species.

6. Planting of 68.4 ha of native woodland as screening / landscaping at key areas around the scheme infrastructure

A total of 47.5 ha of upland planting and 20.9 ha of riparian planting would be undertaken, designed primarily to help landscape different aspects of the scheme, but also to contribute to biodiversity enhancement, including riparian enhancement. All of the riparian planting areas and the majority of the upland planting areas are within the large deer exclosure. However, five small areas of upland planting are also proposed to the west of the exclosure, totalling 13 ha, to screen the main construction track. These areas would be individually fenced.

Trees would be planted at densities similar to the natural tree densities in each area. The proposed planting mixes are as follows:

- Upland planting mix: downy birch; Scots pine; woolly willow *Salix lanata*; aspen *Populus tremula*; rowan; hawthorn *Crataegus monogyna*; blackthorn *Prunus spinosa*; and juniper *Juniperus communis*.
- Riparian planting mix: downy birch; alder *Alnus glutinosa*; willow *Salix* sp.; and aspen.

Fencing would be made visible through the use of pine slats or bright plastic markers, to protect black grouse from collision risk, if risk assessment shows that this might be required. However, fencelines have been located so as to reduce the need for marking, and thereby reducing overall visibility from a landscape perspective, and minimising the materials required for construction.

No planting would be undertaken in areas of blanket bog or deep peat. Finalised planting areas would be micro-sited to avoid such areas.

Planting would be undertaken over one to two seasons (subject to speed of availability of montane willows) immediately following fence installation, during the construction period.

The long-term aspiration would be to remove all fencing in the longer-term, at a time that habitat conditions and deer densities are deemed suitable to allow for removal of the fencing. High altitude habitats can take time to develop and regenerate, and therefore it is anticipated that the main exclosure fence would need to remain for 25 years. Monitoring would determine when the fences can be removed, whilst maintaining the enhanced habitat conditions.

5.5.3 Deer Management Outwith Deer Exclosure (Objective 4.1)

Deer reductions via culling would be undertaken over the c. 11,390 ha deer control area outwith the deer exclosure, which covers the majority of the Ardverikie estate, including the

proposed bog restoration areas. Deer densities would be reduced to 8 per km^2, a 39% reduction from baseline levels.

As detailed in Appendix 3.6.2, it is proposed that the reduction culling would commence prior to construction, and would be undertaken gradually over four years, with 10 deer per km^2 reached in Year 2, and 8 deer per km^2 reached in Year 4. The rationale for not reducing faster is that intensive culling operations create more movement within a deer population, and this in itself can create trampling damage. A longer reduction period requires more deer to be removed overall, but it allows for a more gradual approach, avoids big operations that deer will inevitably react to and cause them to gather in larger herds, and allows stalkers time to adjust the age structure in a way that retains as many higher value animals as possible. Where trampling damage is to be avoided, it is especially important not to force deer into large, unmanageable herds as this cannot easily be undone. New behaviour will have been learned and passed from one generation to the next.

A deer population model is provided in Appendix 8.6.3. Further discussion on deer population modelling and dynamics is provided in Appendix 8.6.2. This provides details of the population model, with associated metrics and considerations, that would facilitate the proposed deer management. The population modelling highlights an uncertainty going forwards, which is the level of emigration and immigration between neighbouring estates, particularly emigration towards the lower populations at Corrour Estate. It is therefore proposed that there is a check during the reduction culling, so that adjustments can be made to the culls as required. As such, a helicopter deer count is proposed for the Spring of 2026.

Once the targeted deer reduction density is reached, deer densities would be maintained at that level via ongoing culling. Deer densities may require adjustment as part of ongoing adaptive deer management, if peatland restoration objectives and other relevant BEMP objectives are not being met, determined by ongoing monitoring (see Section 6.0).

5.5.4 Watercourse and Aquatic Enhancement (Objectives 5.1, 5.3, 5.4, 5.5)

The Allt Labhrach, which joins Loch Earba with Loch Laggan, is currently depleted due to existing hydro development, and it receives no hands-off flow. This watercourse would be restored and enhanced via rewetting, along its c. 2.2 km stretch.

The instalment of ‘large woody structures’ in littoral zone areas would also be undertaken. These would be installed in waterbodies within the Ardverikie Estate not affected by water level changes by the proposed development, such as the reservoir downstream of the Shuas dam and Loch Coire Chuir.

Improvement of spawning habitat quality is also proposed on the Moy Burn. Re-profiling of the substrate, introduction of finer substrate suitable for spawning (gravel/pebble) and the removal of barriers would make larger areas of the burn accessible to Arctic charr and brown trout. Alternatively, enhancement works via the addition of a side channel would also be considered, subject to ongoing consultation with SEPA. The final details would be included in the detailed BEMP.

Marginal loch spawning habitat would be maintained through the creation of habitat in the form of terraced ‘pools’ approximately 1 m deep. This would be designed to contain optimal spawning substrate types for both Arctic charr and brown trout.. Macrophyte species identified within baseline surveys would be planted within terraced areas in greater densities to provide equal and/or improved habitat for fish and macroinvertebrates. This would additionally aid in sustaining a food source for littoral zone feeders (e.g. brown trout). Whilst there is an acknowledged risk of fish entrapment in pools, this is considered of lower impact than not providing compensatory macrophyte and macroinvertebrate populations.

Artificial floating spawning nests would be installed into Loch Leamhain and Loch Earba. The artificial structures would incorporate known requirements of Arctic charr including depth, depth of substrate and type of substrate. Structures would be suspended via buoys at a constant depth to maintain favourable depth. This would be anchored to the loch bed with sufficient chain to allow the structure to rise and recede with the fluctuations in water level during operational periods.

5.5.5 Rhododendron Control (Objective 6.1)

In order to protect woodland regeneration in the area, and enhance existing habitats, *Rhododendron ponticum* would be removed, and the area would be monitored for regrowth for at least ten years, with repeated management as necessary.

Areas supporting *Rhododendron ponticum*, proposed for control, are shown in Figure 8.6.1, and comprise a c. 2 km stretch along an existing track by Loch Laggan north of the Site, and smaller scattered areas within the Site.

5.5.6 Bracken Control (Objective 7.1)

A c. 10.6 ha area on the north bank of Loch Earba is proposed for bracken control (see Figure 8.6.1). This area proposed for bracken control encompasses bracken stands (both dense and scattered bracken) within or adjacent to habitat patches of native woodland, marshy grassland, acid grassland and heath, with scattered trees.

Asulam, a herbicide most commonly historically used for bracken control, is not currently authorised for use in Scotland[56,57]. If Asulam or another suitable herbicide is authorised for use in Scotland at the time of BEMP implementation, then this control method can be used. Non-chemical approaches to control of bracken such as cutting would be required if a suitable herbicide is not readily available. Non-chemical methods have been found to be effective at controlling bracken[58] .

The approach to bracken control would follow best practice[59] and would be set out in the detailed BEMP, taking into consideration availability of appropriate herbicides at that time, and would be agreed in consultation with key stakeholders including NatureScot and SEPA. Care would be taken if herbicides are to be used near watercourses. Follow-up treatment and aftercare will be required, to ensure bracken continues to be suppressed, with the treatment programme required dependent upon bracken recovery rates, determined by monitoring.

It is expected that flora associated with the habitat mosaics would naturally regenerate following bracken control, from the existing seed bank. However, if this is not the case, such as within patches of particularly dense bracken (as determined through monitoring), then remedial action would be undertaken, such as re-seeding or tree planting (see Section 6.1.8).

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[56] https://www.brackencontrol.co.uk/ [Accessed in December 2023]

[57] https://www.webarchive.org.uk/wayback/archive/20220726135114/https:/www.nature.scot/doc/bracken-control-guide-best-practice [Accessed in December 2023]

[58] Marrs R.H., Lowday J.E., Jarvis L., Gough M.W. & Rowland A.P. (1992) Control of bracken and restoration of heathland. IV. Effects of bracken control and heathland restoration treatments on nutrient distribution and soil chemistry. *Journal of Applied Ecology*, 29, 218-225

[59] SEARS (2008) Bracken control: A Guide to Best Practice. Available online: https://www.webarchive.org.uk/wayback/archive/20210721104123mp_/https://www.nature.scot/sites/default/files/Publication%202008%20-%20Bracken%20Control%20-%20A%20Guide%20to%20Best%20Practice.pdf [Accessed in December 2023]

5.5.7 Boxes and Other Species-specific Habitat Features

The following species-specific habitat features would be installed, to provide species-specific compensation and enhancement (see Figure 8.6.1). Box and habitat features would be sited, and their installation overseen, by a suitably experienced ecologist. Details of the compensatory habitat features that provide mitigation for the loss of protected species resting places would be agreed with NatureScot, as part of the protected species licencing process (see Volume 1, Chapter 8: Terrestrial Ecology of the EIA Report for further details). Specific locations for boxes / other habitat features would be identified and agreed within the detailed BEMP.

5.5.7.1 Bats (Objective 10.1)

Bat species (common pipistrelle, soprano pipistrelle, brown long eared bat and *Myotis* sp.) have been recorded within the Site, particularly in the area surrounding Loch Earba or woodland to the north, and along the River Spean. Some habitat used by bats would be lost as a result of the Proposed Development, including 11 trees with bat roosting potential, one of which is a confirmed common pipistrelle day roost.

A total of 50 bat boxes would be installed, on mature trees in retained woodland, and on the new proposed bridge crossing over the River Spean. Boxes would be situated in areas where the species have previously been recorded, in suitable habitat.

The specifications would include at least five boxes suitable for maternity colonies, at least five boxes suitable for hibernating bats, with the remaining suitable for typical summer roosts. The box specifications would be suitable for crevice-dwelling species known to occur on the Site including pipistrelles, brown long-eared bat, and *Myotis* sp.

Eleven boxes would provide roosting habitat compensation for the confirmed roost and trees with Potential Roosting Features being lost, and the remaining 39 would provide a roosting enhancement.

5.5.7.2 Red squirrel (Objective 10.1)

A total of 50 red squirrel boxes would be installed on mature trees within retained woodland. One of these boxes comprises compensatory habitat (to compensate for the small-scale loss of woodland habitat, equivalent to less than one home range[60]), whilst replacement woodland creation matures. The remaining 49 boxes comprise an enhancement for red squirrel.

5.5.7.3 Pine marten (Objective 10.1)

A total of 30 pine marten boxes would be erected on mature trees within undisturbed areas of retained woodland. One of these boxes comprises compensatory habitat (to compensate for the small-scale loss of woodland habitat, equivalent to less than one territory[61]), whilst replacement woodland creation matures. The remaining 29 boxes comprise an enhancement for pine marten.

[60] Harris, S. and Yalden, D.W. (2008) *Mammals of the British Isles: Handbook (4th Edition).* The Mammal Society, Southampton

[61] Scottish Wildlife Trust (undated*) Scottish Wildlife Trust Position Statement: Pine marten (Martes martes)* [online] Available at: https://scottishwildlifetrust.org.uk/wpcontent/uploads/2016/09/002_293__pinemarten_positionstatement_1389006309.pdf [Accessed in November 2023]

5.5.7.4 Reptiles (Objective 11.1)

Ten reptile hibernacula would be constructed to compensate for the loss of reptile habitat. The design features would follow those detailed in the Reptile Habitat Management Handbook[62]. The hibernacula would be located in suitable reptile habitat, including dry heath areas, and the southern margins of retained and new woodland areas, away from areas with potential to flood or become waterlogged. Materials won during habitat clearance would be used for the construction of the hibernacula where possible.

Log piles would be created using logs and brash from tree felling activities during construction. Log piles would be situated within and on the margins of retained and newly created / restored woodland areas, facing a range of aspects, to create a mixture of sunny and shady conditions. The log piles would benefit reptiles, as well as a range of invertebrates.

5.5.7.5 Divers (Objective 12.1)

Historic bird data for Ardverikie Estate obtained from the RSPB suggests that black-throated diver possibly bred on the Earba lochans prior to the original Ardverikie hydro scheme being constructed. More recently, a diver raft installed on Loch Meall Ardruighe has had a 60% breeding success rate over the past three decades, and a further raft installation on Loch Pattack has enjoyed annual breeding success over the past few breeding seasons.

Following further monitoring of both the group of black-throated divers that currently congregate on Loch Earba and monitoring of suitability of both Loch Earba and other waterbodies within Ardverikie Estate, additional rafts would be provided in suitable locations within the estate, informed by monitoring results and in consultation with the RSPB Diver Raft Programme. The suitable placing of diver rafts may encourage more breeding pairs to take up residence, creating an important local breeding population for this rare breeding species.

5.5.8 Habitat Reinstatement (Objective 8.1)

Reinstatement of areas subject to temporary disturbance / damage during construction (i.e., within the working corridor, but beyond the permanent infrastructure or inundation areas) would be undertaken as soon as reasonably practical following construction. Prompt implementation of reinstatement measures would aim to reduce the effects of compaction of subsoil (which can lead to inhibited drainage and root growth), and exposed ground (which can cause loss of topsoil, dust and water pollution through wind blow and erosion). Prompt reinstatement would also help to ensure integrity of the vegetation seed bank is maintained.

Planned reinstatement would be informed by further consultation with stakeholders, pre-construction surveys and site conditions. Reinstatement details would be included and confirmed in the CEMD and detailed BEMP, post consent. Reinstatement is likely to comprise the following considerations and measures:

- Temporary working areas will be reinstated to their original condition and returned to their previous use, usually within the autumn following the construction phase;
- Excavated materials would be stored according to good practice taking care to separate turves, topsoils, soils and peat layers;

[62] Edgar, P., Foster, J. and Baker, J. (2010). Reptile Habitat Management Handbook. Amphibian and Reptile Conservation, Bournemouth

- Reinstatement would ensure that soils are carefully replaced in the correct soil profile, and that turves are replaced on the surface;
- Where compaction may have occurred a 'sub-soiler', which lifts and shatters the subsoil will be used before the topsoil is reinstated, if necessary;
- Stripped soil will be reinstated as close to where it was removed as possible; and
- Reinstatement works would be undertaken in suitable weather conditions, avoiding very wet conditions or very hot, dry and windy conditions, if possible.

Natural regeneration of habitats will be promoted as advised by the Ecological Clerk of Works (ECoW).

The majority of the areas within the temporary working corridor to be re-instated currently comprise grasslands (acid / calcareous / marshy) and heathland (wet and dry). Blanket bog is also present within the temporary working corridors.

Once construction has finished and the soils and turves have been replaced in the correct profile, it is expected that grassland and heathland vegetation would be allowed to naturally re-generate from the seed bank within the soil and seeds from the turves and adjacent vegetation.

The re-establishment of heathland involves the development of ericoid dwarf shrub dominance which then creates a micro-climate suitable for establishing and maintaining heathland vegetation[63]. Heather seeds have long longevity (up to 70 years in some situations), and therefore there should be a good viable seed source within the soil. On this basis, there is a high likelihood that the natural regeneration of heathland vegetation would be successful. Similarly, it is expected that the grasslands would regenerate from the existing seed bank.

However, this would be monitored and in the unlikely event that natural regeneration of heathland or grassland vegetation is unsuccessful within a reasonable timescale, then remedial measures will be considered, such as seeding, spreading heather brash, or using donor turves (see Section 6.1.8).

The above works are expected to result in the reinstatement of the following habitat areas (totalling c. 91 ha):

- 4.85 ha of semi-improved and unimproved acid grassland;
- 0.45 ha of unimproved calcareous grassland;
- 20.88 ha of marshy grassland;
- 1.35 ha of dry dwarf shrub heath (including in mosaic with calcareous grassland);
- 54.98 ha of wet dwarf shrub heath;
- 0.07 ha of montane heath / dwarf herb; and
- 0.12 ha of acid / neutral flush or bryophyte dominated spring;
- 1.0 ha of dense scrub;
- 0.35 ha of bracken (although reversion to heathland would be targeted in this area); and

[63]Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection Agency, Forestry Commission Scotland and Historic Environment Scotland (2015) Good Practice during Wind Farm Construction. Version 3.

- 0.19 ha of scree and exposed rock habitats.

In addition, 6.51 ha of bog habitats occur within the temporary working corridor. Habitat loss calculations are based on the precautionary assumption that these bog areas would be permanently lost, although in practice every effort will be made to reinstate these blanket bog habitats, where possible. In a worst-case scenario, these areas would revert to heathland, rather than being lost. Details would be provided in a Peat Management Plan (PMP).

5.5.9 Plant translocation (Objective 9.1)

Prior to the commencement of construction, translocation of the following important plant species, which lie within the proposed working corridor or infrastructure / inundation footprint, would be undertaken: downy willow (four locations identified in baseline surveys); field gentian (one location); petty whin (one location); and hawkweed sp. (three locations within upland species-rich ledge habitat).

Translocation details would be provided in the detailed BEMP.

An update survey would be undertaken in the flowering season prior to construction, to gather up-to-date survey information on the location of these species within the working corridor/infrastructure/inundation areas, and the locations of individual plants would be marked. The plants would be translocated to suitable retained habitat areas, and their locations recorded and marked, to allow for monitoring of success. Receptor sites would be selected for translocation, that contain the same habitat type and conditions. Baseline habitat surveys confirm that such habitats exist for the plant species targeted, within retained habitat areas within the wider Site boundary. The translocation would follow the Scottish Code for Conservation Translocation[64] and best practice guidance[65].

Successful translocation of downy willow has been reported in published literature, e.g. Pogorzelec et al. (2020)[66]. Although limited published literature exists on translocation results for the other species targeted, it is expected that the presence of suitable receptor habitat within close proximity to the areas that the individual plant specimens would be translocated from, increases the likelihood of success.

The success of the translocation would be monitored as part of the BEMP monitoring programme (see Section 6.0).

5.6 External Factors

It is important to note that external factors such as climate change can influence habitat restoration success. Over the lifetime of the BEMP it is possible that climate change will affect the habitats on site and in the surrounding area. This should be taken into account during monitoring and reporting, including monitoring of control areas (see Section 6.0).

[64] National Species Reintroduction Forum (2014) *The Scottish Code for Conservation Translocations*. Scottish Natural Heritage.

[65] National Species Reintroduction Forum (2014) *Best Practice Guidelines for Conservation Translocations in Scotland Version 1.1*. Scottish Natural Heritage.

[66] Pogorzelec, M., Parzymies, M., Banach-Albinska, B., Serafin, A. and Szczurowska, A. (2020) Experimental reintroduction of the boreal species Salix lapponu L. to refuges at the southern limit of its range – short-term results. *Boreal Environment Research* 25: 161 – 169.

5.7 Ongoing Management and Maintenance

The requirement for ongoing management and maintenance will be determined based on monitoring results (see Section 6.0). Requirements are likely to include:

- Peatland restoration areas:
  - Repair of any dams that are eroded or otherwise damaged, as required, subject to the outcome of monitoring (see Section 6.3).
- Bracken control area:
  - Additional treatments of bracken, if eradication is not possible.
- Rhododendron control areas:
  - Additional treatments of Rhododendron, e.g. if new plants are identified.
- Deer control areas:
  - Ongoing deer control to maintain the target density.
- Enclosed woodland regeneration / creation area:
  - Removal of any non-native conifer regeneration arising from the woodland strip alongside Loch Laggan. This would be undertaken at least every five years (if required), with the optimal removal frequency determined by the results of monitoring (see Section 6.0).
  - Weeding or beating up of trees in the tree planting areas, applying fertiliser (if required), as required during establishment, informed by monitoring (see Section 6.4).
  - Ongoing repair of any damaged fencing, and removal cull of any deer that have breached the deer exclosure area. The fence line would be inspected every three months for damage or weaknesses, and repaired as required. On this same schedule, the enclosure would be checked for deer that may have breached the fence line, using a thermal drone. Any such deer identified within the enclosure would be culled.
- Boxes and other species-specific habitat features:
  - Replacing any damaged or missing boxes and habitat features.

Further remedial action may be required if monitoring indicates that the BEMP goals and objectives are not being met, as detailed in Section 6.1.8.

6.0 Monitoring and Review

All monitoring would be undertaken by suitably qualified and experienced environmental professionals.

The purpose of the proposed monitoring is twofold. First it would aim to document the development of habitats within the BEMP areas, which would determine the extent to which the overall goals and objectives of the BEMP are being met. Secondly, it would inform the need for ongoing adaptive management and remedial action.

Monitoring would record the following indicators, as appropriate, to monitor progress towards achieving the BEMP goals and objectives:

- Condition of restored, created and reinstated habitats, including herbivore impacts;
- Bracken and Rhododendron cover;
- Water table;
- Tree growth and survival;
- Uptake / functionality of boxes and other species-specific habitat features; and
- Translocated plant survival.

6.1 Botanical Monitoring

6.1.1 Drone survey

A drone survey or other aerial photography survey would be undertaken of the BEMP areas, to document the baseline and monitor vegetation changes using drone-captured high-resolution aerial images. This survey technique would first be undertaken prior to restoration measures to provide an up to date baseline. This would then be undertaken in Year 1 and Year 5 after completion of the initial restoration measures, and repeated every five years until at least Year 20, with the frequency of further monitoring determined in Year 20. The drone surveys would be undertaken during summer, at a similar time of year each year, to allow for comparison of the captured aerial photographs to be undertaken to establish if, and to what extent, restoration of the target vegetation has taken place. The survey would also be used to monitor bracken and tree regeneration extent.

The drone survey would be supported by ground-based botanical monitoring. The methods of botanical monitoring would be detailed in the BEMP and would be bespoke to allow for the specific monitoring against the BEMP objectives. The likely methodologies are summarised below.

6.1.2 Common Standards Monitoring

The ground-based botanical monitoring for BEMP areas, is likely to be based on the Common Standards Monitoring (CSM) protocol for upland habitats[67] (or successor if this is updated prior to monitoring commencing), which assesses habitat condition.

CSM provides a detailed insight into the changes in vegetation and some abiotic factors that pick-up trends in vegetation changes that are valuable to understanding the progress of habitat restoration and management works and informing further management. CSM is

[67] Joint Nature Conservation Committee (2005) *Common Standards Monitoring Guidance for Upland Habitats*. Version May 2005. Joint Nature Conservation Committee, Peterborough.

designed to assess whether features (e.g., habitats) are in favourable or unfavourable condition and whether condition is being maintained, recovering, or declining over time. The assessment is based on habitat-specific criteria involving key indicator species and vegetation structure.

CSM would be undertaken in the peatland restoration areas, and control sites, to assess the progress of restoration techniques implemented. CSM would also be undertaken at sample locations across the deer control areas, monitoring the change in habitat condition driven by the restoration and management actions.

The thresholds in CSM that delineate habitats in favourable condition from those in unfavourable condition were designed to equate to the minimum standard for SSSI site selection[68]. The objective of this BEMP is to improve habitat condition compared to baseline condition, not to meet the minimum standard for SSSI site selection. The threshold conditions would therefore be adjusted accordingly following the first round of CSM data collection. CSM targets would then be updated in the next BEMP revision.

CSM transect lines would be set up in peatland restoration areas to give coverage of each restoration area. Transects would also be set up within the bog control areas, and a sample of upland habitats within the deer control areas. Grid references would be recorded to allow re-location on return monitoring visits. Quadrat sampling along the transect lines would use 2 m x 2 m quadrats.

The criteria used to assess the data from each quadrat would depend on the vegetation community within the quadrat. CSM guidance provides a list of which NVC communities compose each of the broader habitat types that CSM relates to. Therefore, the surveyor would record the NVC community for each quadrat to make sure that it is assessed using the correct criteria.

6.1.3 Peatland Condition

Peatland restoration areas would also be monitored for Peatland Condition, using criteria within NatureScot's Peatland Action Peatland Condition Assessment Guide[69], with the peatland restoration areas being classified as in 'near-natural, modified, drained or actively eroding' condition. A condition of 'near-natural' would be targeted for peatland restoration areas. This assessment would be undertaken alongside the CSM monitoring, following the same programme.

6.1.4 Herbivore Impact Assessment

Monitoring would assess the impacts of herbivore grazing/browsing across the BEMP areas. The assessment would follow the Best Practice Guides' Habitat Impact Assessment (HIA)[70] method for assessing deer impacts, for dwarf shrub heath and blanket bog. The assessment would be undertaken at representative sample locations across the BEMP areas, in the same locations as the CSM monitoring so that these surveys can be undertaken at the same time. A HIA would be undertaken within each CSM quadrat, and within the area surrounding each CSM quadrat where the assessment calls for a larger sample area.

[68] JNCC (2004) Common Standards Monitoring Guidance for Habitats. Peterborough: Joint Nature Conservation Committee

[69] https://www.nature.scot/sites/default/files/2023-02/Guidance-Peatland-Action-Peatland-Condition-Assessment-Guide-A1916874.pdf [Accessed in January 2024]

[70] https://bestpracticeguides.org.uk/statutory-guides/deer-impacts/ [Accessed in January 2024]

A reduction in deer impacts over time is targeted, with 'light' impacts in relation to browsing and trampling targeted across all sample quadrats using the methodology.

6.1.5 Bracken

Within bracken control areas, notes would be taken on the % cover of bracken and its health. Re-growth would be monitored annually for the first five years, and then monitoring would continue in tandem with the botanical monitoring programme.

6.1.6 Rhododendron

Areas where the removal of Rhododendron has taken place would be monitored yearly following treatment, for a minimum of five years, and thereafter as required based on assessments of regeneration. Where Rhododendron is regenerating, or in other areas where new plants are identified, further treatment should be applied to keep this species under control.

6.1.7 Monitoring Programme

Botanical monitoring would be undertaken during the optimal survey period for plant species (May – August inclusive). As with the drone survey, the botanical monitoring (excluding monitoring of bracken and Rhododendron) would be undertaken during the summer prior to restoration measures, to provide a baseline. Further monitoring of the BEMP areas (to assess changes to the baseline) would then take place in the first year following restoration, then again in Year 5, and repeated every five years thereafter, until at least Year 20, with the frequency of further monitoring determined in Year 20.

6.1.8 Remedial Action

Should the botanical monitoring find that target conditions, and therefore the goals and objectives of the BEMP are not being met, then remedial action would be employed, and the BEMP updated accordingly, in consultation with the BEMP Working Group.

Remedial actions would be dependent on the habitat and nature of the goal / objective not being met. Possible remediation measures could include:

- If bog plants are not successfully regenerating in peatland restoration areas as expected, then re-seeding / re-vegetation techniques would be explored;
- If bracken persists within bracken control areas, then repeat treatment and aftercare would continue as required, or alternative treatments tried, to suppress bracken growth;
- If monitoring shows that herbivore impacts are too high, and are resulting in peatland restoration objectives or other relevant restoration objectives not being met, then deer densities could be reduced or other measures employed to allow the objectives to be met.

6.2 Monitoring of Peatland Restoration Water Table Height

Monitoring of water table height within peatland restoration areas would take place by the installation and monitoring of hand-driven dipwells (or a similar method for monitoring water table levels). If feasible, dipwells would be installed prior to peatland restoration actions, to enable a baseline to be established. The location and density of dipwells would be determined within the detailed BEMP.

Unless the water table monitoring method selected allows for continuous data logging at set intervals, quarterly monitoring of dipwells would be undertaken in each monitoring year, to measure water levels and assess if they are high enough to promote bog vegetation growth.

Dipwell monitoring would be undertaken prior to the peatland restoration works to provide a baseline (where feasible), as well as in the first year and fifth year following restoration, with the need for further monitoring determined in year five, depending on monitoring results.

6.3 Checks of Bog Restoration Dams

For the peatland restoration to be successful the dams that are created during the restoration process need to remain effective. During ditch / gully blocking, all the dam locations would be recorded.

In the first two monitoring years all the dam locations would be checked for signs of effectiveness, damage and requirements for maintenance. In subsequent monitoring years (alongside the botanical monitoring), especially if dam performance has been good with little maintenance requirement, then it may be appropriate to spot check only a proportion of dam locations.

6.4 Monitoring of Newly Created Woodland

A suitably experienced woodland specialist would inspect the implementation of the native woodland restoration and creation. Reviews would be at regular intervals (Years 1 - 5 and 10) to ensure that the trees are planted correctly, maintained to the required standard, and ultimately established into woodland.

Further management actions would be decided following each visit, including potentially beating up, weeding, and applying fertiliser (restricted to higher altitudes, where required). There would be no chemical weed control.

6.5 Monitoring of Translocated Plants

Monitoring would aim to determine the effectiveness of the plant translocation, in terms of growth and survival. A monitoring programme would be provided in the detailed BEMP, but is envisaged to include annual monitoring in Years 1 – 3, followed by ongoing checks in tandem with the botanical monitoring programme.

6.6 Monitoring of Boxes and Other Species-Specific Habitat Features

The boxes and other habitat features (listed in Section 5.5.7) would require a regime of inspection, such that damaged features can be identified, fixed, or replaced. The precise details will be developed and contained within the final BEMP.

6.7 Ornithological Monitoring

Monitoring of the black-throated diver population would be undertaken, to understand any effect of the levels of inundation. The results of the monitoring would be used to inform the installation of a diver nesting raft(s), if considered appropriate in the light of monitoring results. Diver monitoring would be undertaken during construction, and for five years post-construction (assuming that the congregation of divers remain on Loch Earba and the existing nest raft remains in use).

Golden eagle monitoring would also be undertaken, which is covered in a separate draft golden eagle protection plan (EIA Appendix 10.1.3), and is not detailed within this document.

6.8 Aquatic Monitoring

A programme of water quality and aquatic monitoring would be undertaken during and after construction (see EIA Chapter 11: Aquatic Ecology), which would be included in the CEMD, and is not detailed within this document.

6.9 Reporting and Review

Monitoring results would be reported annually (in years when monitoring takes place) and recommendations made for changes to management prescriptions if objectives are not being met, as appropriate. As such, the BEMP would be a live document, such that it can be altered following monitoring results, unexpected events or evolving guidance. Any amendments to the BEMP because of the outcome of monitoring would be agreed with the BEMP Working Group in advance of any such revised prescriptions being implemented (see Section 4.0). The BEMP would be reviewed every five years.

7.0 Indicative Programme

An indicative programme for the implementation of management and monitoring works set out in this OBEMP is provided in Table 7-1. A more detailed programme would be provided in the detailed BEMP, post consent.

Table 7-1: OBEMP Outline Schedule of Works

Task	Pre-construction	Construction (5-6 yrs)	Post-Construction								
			Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 10	Yr 15	Yr 20	Beyond Yr 20
Enabling Tasks											
Formation of BEMP working group											
Detailed BEMP preparation and finalisation											
Drain mapping / slope surveys, peat depth survey, Peat Slide Risk Assessment, drone orthomapping analysis, HIA, and CEMP, for Bog Restoration Areas.											
Dipwell installation in Bog Restoration Areas											
Capital Works and Ongoing Management											
Deer control: deer count (Spring of 2026)											
Deer control: reduction culling (over 4 yrs)											
Peatland restoration works (damming, re-profiling, bare peat restoration)											
Bracken & Rhododendron control											
Fence installation for deer exclosure											
Tree planting											
Woodland creation aftercare and review period											
Removal of non-native conifer regeneration in deer exclosure area (if required)											
Checks of fence lines, check and cull of any deer within the exclosure area (every three months)											
Remove fencing (assess suitability of conditions at Yr 25)											

Task	Pre-construction	Construction (5-6 yrs)	Post-Construction								
			Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 10	Yr 15	Yr 20	Beyond Yr 20
Aquatic enhancement: Moy burn spawning habitat improvements, re-wetting of Allt Labhrach, installation of large woody structures, creation of marginal loch spawning habitat 'terraced pools', installation of artificial floating spawning nests											
Plant translocation											
Create species-specific features: pine marten boxes, red squirrel boxes, bat boxes, reptile hibernacula, log piles, diver rafts											
Install diver rafts (subject to monitoring)											
Re-instatement of habitats within temporary construction corridors											
Deer control: on-going control at reduced density											Ongoing for lifetime of the project
On-going adaptive management and maintenance											
Monitoring and Associated Reporting											
Drone survey											Requirement for further monitoring to be determined by monitoring results in Year 20
Botanical monitoring surveys											
Drain blocking checks											
Dipwell monitoring											
Monitoring new woodland establishment											

Task	Pre-construction	Construction (5-6 yrs)	Post-Construction								
			Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 10	Yr 15	Yr 20	Beyond Yr 20
Monitoring translocated plants											
Diver monitoring											
Monitoring functionality of boxes / species-specific habitat features											
BEMP Review and Adaptation											
BEMP review and updates											Every five years for lifetime of project
Ongoing adaptive management via agreement with BEMP working group (if required throughout)											

Table key:

UNDERTAKE	*IF REQUIRED*

245000 250000 255000 260000

785000

780000

Note:

Within Retained Woodland, Erect:
-Bat Boxes (x 50)
-Red Squirrel Boxes (x 50)
-Pine Marten Boxes (x 30)

Within Woodland Margins and Retained Heathland, create:
-Reptile Hibernacula (x 10)

Within Retained Woodland and Woodland Margins, create:
-Log Piles

Provision of Diver Rafts (Details and Locations to be Confirmed)

Installation of Large Woody Structures in Littoral Zones (Locations to be Confirmed)

Creation of Terraced Pools for Marginal Loch Spawning Habitat, within Loch Earba

Provision of Artificial Spawning Nests within Loch Leamhain and Loch Earba

Loch Laggan

N

0 2 4
Kilometres

LEGEND

- Site Boundary
- Permanent Infrastructure Footprint
- Ardverikie Estate Boundary
- Rhododendron Control Points
- Improvement of Moy Burn Spawning Quality
- Rhododendron Control
- Watercourse Enhancement – Re-Wetting (Allt Labhrach)
- Deer Exclosure Area
- Deer Control Area
- Bracken Control Area

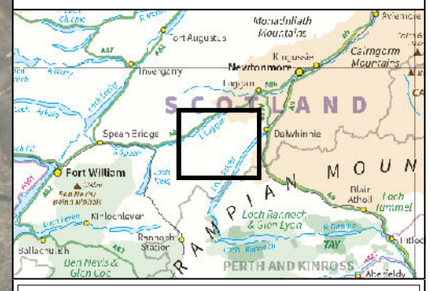
Suitable Areas of Bog Restoration

625 ha of Direct Bog Restoration Would be Undertaken Within the 1,031 ha of Suitable Bog Restoration Areas Shown

- Primary Bog
- Secondary Bog
- Tertiary Bog

Woodland Restoration Zoning

- Ancient Woodland Within Enclosure
- LEPO Woodland
- Possible Regeneration Area
- Zone 1 - Native Woodland Planting at 1100 Trees per Hectare
- Zone 2 - Low Density Planting at 625 Trees per Hectare
- Zone 3 - Montane Planting at 200 Trees per Hectare
- New Tree Planting - Riparian Mix
- New Tree Planting - Upland Mix



EARBA STORAGE
A GILKES ENERGY COMPANY

SLR

EARBA

TERRESTRIAL ECOLOGY

PROPOSED BEMP AREAS

FIGURE 8.6.1

Scale 1:60,000 @ A3

Date FEBRUARY 2024

428.013028.00001.0048.0 Proposed BEMP Areas

Appendix 8.6.1 Phase 1 Overview / Peatland Restoration Assessment Report (Angus Davidson Ltd)

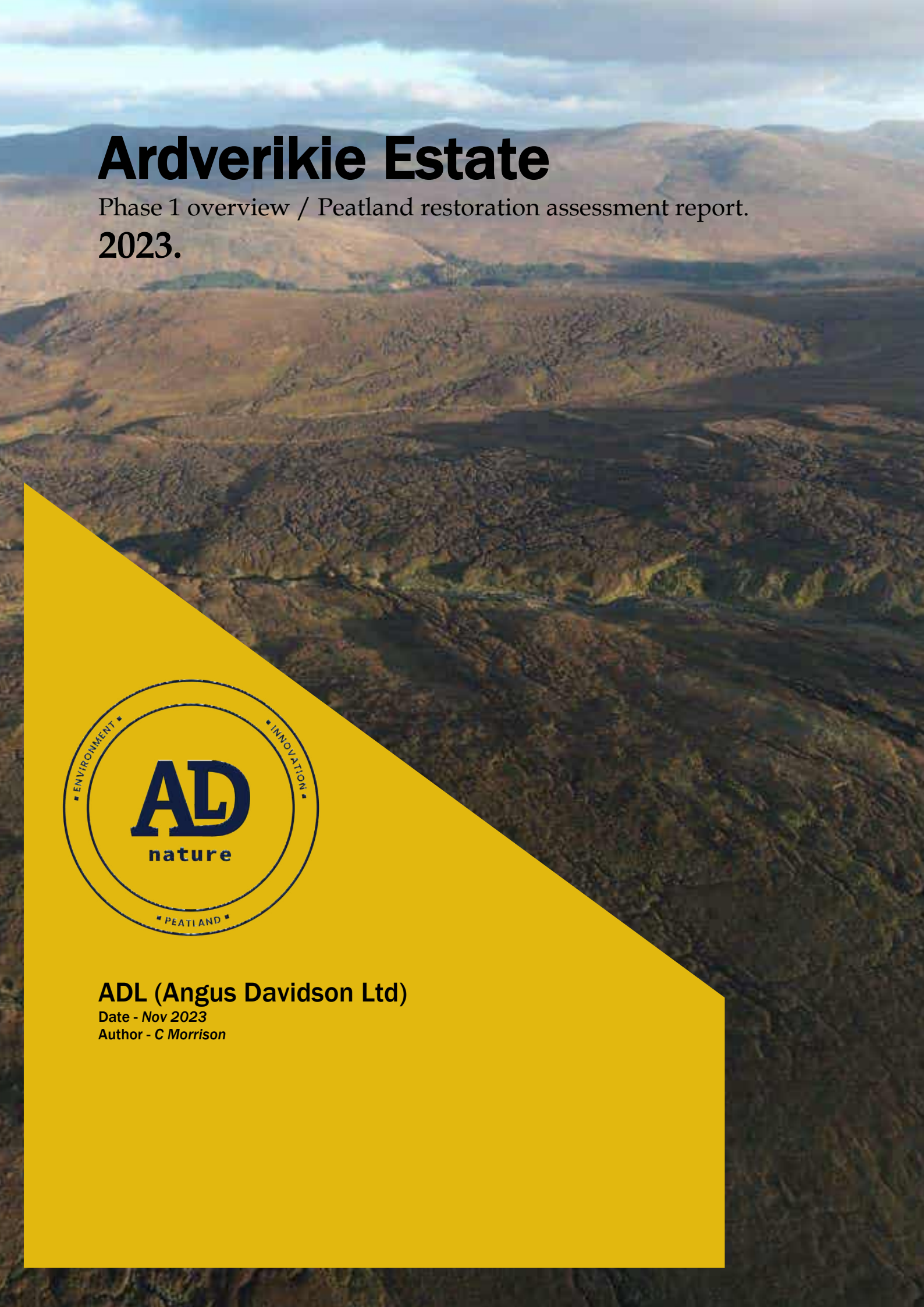
EIA APPENDIX 8.6: Outline Biodiversity Enhancement and Management Plan

Earba Pumped Storage Hydro Scheme

Earba Limited

SLR Project No.: 428.013028.00001

28 February 2024



Ardverikie Estate

Phase 1 overview / Peatland restoration assessment report.

2023.

ADL (Angus Davidson Ltd)

Date - *Nov 2023*

Author - *C Morrison*

CONTENTS

Overview

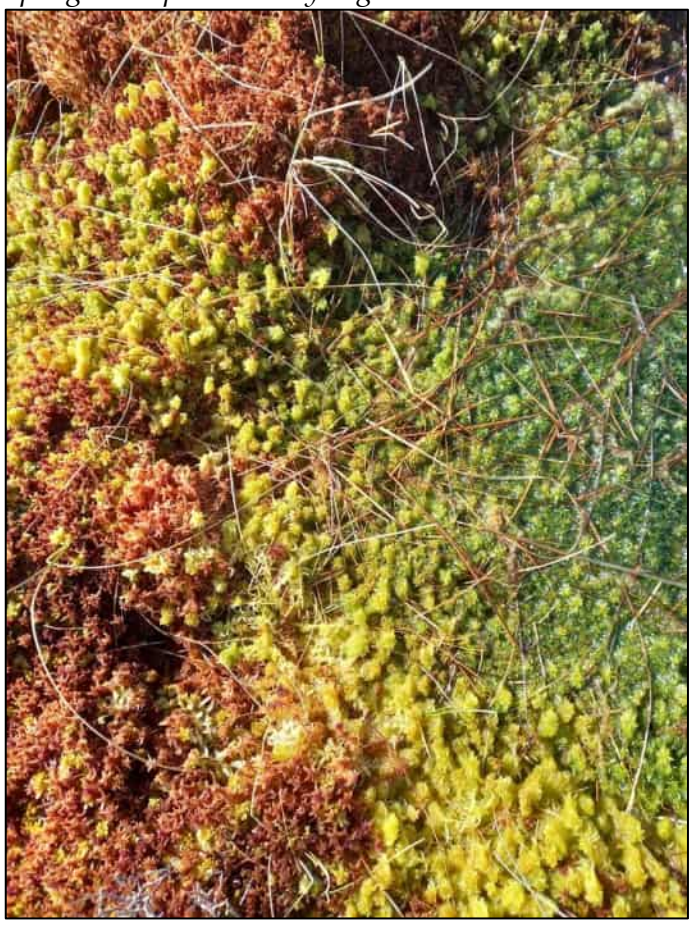
Overview

The premise of this report underlines the primary areas of degraded blanket bog habitats requiring restoration, next steps, techniques applicable and general timelines.

This is supported by a phase 1 assessment to determine the different types of habitats at a level that meets current JNCC (*Joint Nature Conservation Committee*) standards for standardised descriptions, classification, and mapping of wildlife habitats.

A desktop survey has also been undertaken to identify any constraints in terms of designated habitats and species (as well as mitigation measures).

Sphagnum sp – Primary bog builder



1. SUMMARY

This report gives an overview of the primary areas suitable for peatland restoration on Ardverikie estate. Of particular importance are montane habitats over 600m, and these have been identified spearately on maps.

The areas identified as suitable for restoration are detailed in **Table 1** below, which separately identifies:

- areas that have been surveyed on the ground;
- areas identified by aerial mapping that have yet to be surveyed on the ground; and
- the effective areas of habitat restored, including units of bog habitat that would not be directly restored, but would be indirectly restored by the influence of the restoration of the adjacent directly restored areas.

Table 1

Peatland Restoration Areas	Below 600m	Above 600m	Total
Currently surveyed direct restoration area	582ha	395ha	978ha
Direct restoration area, subject to ground survey	26ha	28ha	54ha
Total direct restoration area	608ha	423ha	1031ha
Additional area of indirect restoration	65ha	158ha	223ha
Effective Total Habitat Area Restored	673ha	581ha	**1254ha**

The assessment techniques used for this survey have been developed by ADL over the last 6 years and around 40 separate projects. In order to identify the suitablity of a site, typical parameters would include: -

- ***Habitat type*** *– is the vegetation loose and unconsolidated (poor potential) or robust with species like Calluna vulgaris, Scirpus cespitosus, Erica sp, and Juncus squarrosus (High potential)*
- ***Herbivore impacts*** *– Aerial and walkover components alongside discussions with estate managers look at long term (habitat) trends and current/proposed management of herbivore numbers (usually deer). Restoration is most affected by inappropriately high numbers of herbivores and should not be undertaken without a clear understanding of local herbivore management.*
- ***Access*** *– can the site be accessed easily by equipment (slope, river crossings, designated areas)*
- ***Peat depth*** */ slope / channels / soil strength – the structure of the peatland can impact access and the type of restoration utilised. "Bog bursts", slippage and damage from tracking can play key roles in restoration practice.*
- ***Bare areas*** *– is there enough material in the form of brash (grass/heath clippings) available locally and how will it be transported (by vehicle or helicopter).*
- ***Tree stumps*** *were noted as a key feature on Ardverikie and this is a highly useful tool to manage drainage in a way that traps sediment and vegetative material, while allowing for runoff to flow slowly through the site*
- ***Slope / channels*** *can be affected by localised vegetation types, availability of tree stumps, stone and vegetation for dams. A "cascade failure" can take place if channels are impounded with dams that are not suitable for the slope angle and runoff characteristics*

The aim of the report is to describe blanket bog habitats suitable for restoration and suitable restoration techniques.

The total area of restoration potential that has been surveyed on the ground to date is 978ha, and this can be found on (**Maps 1, 2, 3**) however, **Map 9** shows some additional areas identified from aerial imagery that still need to be confirmed by a site visit. Other areas may also change (up or down) according to finalised mapping (from drone orthomapping) and peat depth data. **Map 10** indicates areas that benefit both directly and indirectly from peatland restoration.

Statutory designations are noted as: -

- *Ben Alder and Aonach Beag SSSI /SAC (**Map 8**)*
- *Ben Alder SPA (**Map 8**)*

The top two classes in peatlands classified as blanket bog are shown as follows (**Maps 3, 4**): -

- ***Class 1** - Nationally important carbon-rich soils, deep peat and priority peatland habitat / Areas likely to be of high conservation value*
- ***Class 2** - Nationally important carbon-rich soils, deep peat and priority peatland habitat areas of potentially high conservation value and restoration potential*

These are shown in the attached maps using a WMS layer from ScotGov spatial data resources.

Habitats were noted as primarily: -

- *Blanket sphagnum bog (E1.6.1)* – **12.32ha**
- *Raised bogs (E1.6.2)* – **1.58ha**
- *Basic flush (E2.2)* – **1.59ha**
- *Wet modified bog (E1.7)* – **527.16ha**
- *Dry modified bog (E1.8)* – **432.83**
- *Wet Dwarf shrub heath (D2)* – **3.19ha**
- *Marsh/Marshy grassland (B5)* – **0.199ha**

⇐ Whilst not qualifying as Blanket bog habitats, these (2) habitats would be subject to restoration.

Peat depth was not undertaken during the survey, however it was clear that most areas would be at least 1m deep. Some areas however, most notably at elevations over 600m may have small areas that are under 50cm. This would in turn move portions of this habitat outwith the blanket bog classification according to the IUCN peatland code and characteristics outlined in the JNCC Common Standards Monitoring Guidance for Upland habitats. To allow for these uncertainties, the areas identified have been conservatively mapped.

Grazing was noted to be generally moderate or less using the current Habitat Impact Assessment methodology (MacDonald et al 1998) to assess herbivore impacts. Noted on the map however are areas that currently are shown as having either Moderate or Low capacity for restoration, which in some cases is due to herbivore impacts. This is not shown as a separate item as it tends to be in areas that already face other issues (*noted in description of restoration processes*).
Moderate or above grazing would require further discussions with Ardverike estate to find ways to effectively manage current and future population dynamics to prevent long term damage to restoration zones.
It is believed that the current deer population is around 10 deer/km^2. This, while meeting likely ScotGov criteria for overall numbers does not indicate the site specific impacts that hefted herds might have. As already mentioned, some areas face higher than desired deer impacts, and while this can be managed using either increased culls or fencing, this can also have negative effects. These effects may include: -

- *Increased trampling (out of proportion with grazing) due to excessive disturbance*
- *Owners / Land managers may find that proposed increases in culls exceed what they are comfortable with and may inhibit their ability to deliver desired sporting intents.*

- *Damage to adjacent habitats from the movement of deer round fences (this tends to compress impacts)*
- *Herbivore impacts may shift to other areas in ways that that cannot be predicted if specific herds are targated.*

Costs for restoration can range (currently) from around £800/ha to £2500/ha depending on location, access, habitat condtion and peat depth/conditions.

Drone footage

Peatland restoration processes are underpinned by high quality drone footage. ADL have pioneered a number of techniques that deliver a higher standard of resolution and the subsequent interpretation of the footage.

Around 75% of the projected areas have been completed to date (aerials supplied separately) with the rest completed as weather allows use of drones.

2. INTRODUCTION

Remit
This report gives an overview of the primary areas suitable for peatland restoration on Ardverikie estate. Of particular importance are montane habitats over 600m, and these have been identified spearately on maps.

Aims and Objectives
The aim of this report was to define the primary habitat types within areas noted as blanket bog and in a degraded condition. This was undertaken through: -

- *Identification of designations relating to the proposed areas*
- *Broad habitat survey*
- *Identification of restoration approaches*

Ardverikie estate encapsulates an area of almost 16,600ha around LochLaggan in the North central Highlands.
The estate is well known for its diversity of habitats, species and iconic views over towards the Cairngorms, Rannoch moor and its mountains and into the Monadhliaths.

Close to 20% of the estate (2964ha) is covered by Blanket bog habitats identified as Class 1 peatland: -

- *Nationally important carbon-rich soils, deep peat and priority peatland habitat.*
- *Areas likely to be of high conservation value.*

Currently the only herbivores on the estate are Red deer, with a density of around 10 deer / km^2.

3. APPROACH

A two phased approach took place. Firstly to define as much information as could be gathered through a desk based discovery process, and secondly though a field based survey using the JNCC phase 1 survey technique.

Survey boundary and buffers

The survey area is defined in the attached maps (**Maps 1 – 5**)

Habitat designations

The desk based survey utilised data from: -

- NatureScot - sitelink
- NatureScot carbon and peatland shp files from their datahub
- NBN gateway

Survey

The survey to identify blanket bog habitats was undertaken using the JNCC Phase 1 assessment process, and then to define which of these were suitable for restoration.

The subsequent survey of Ardverikie estate was undertaken to define habitats broadly aligned to blanket bog designations. Current survey indications are that there are around **978ha** of blanket bog systems requiring restoration to some degree. This is further enhanced by around an additional **54ha** (**Map 1**) that was not included in the initial survey but was subsequently noted on additional desk top surveys. It is likely then that the final figure will be closer to a final amount of **1031ha.**

In addition, the desktop review of the areas requiring restoration indicates that around **1254ha** of habitat will benefit directly and indirectly from peatland restoration programmes. These include: -

- *Sections between restored channels, hags and bunds likely to benefit from increased water tables which drive sphagnum development;*
- *more appropriate blanket bog species;*
- *better linking of habitats;*
- *Reduced downstream flooding potential;*
- *Protected peatlands become more effective carbon stores and significant reduction in landscape level erosion (sources) and subsequent damage to rivers and downstream wetlands (sinks)*
- *For every hectare of restoration, 5 tonnes of carbon can be sequestered every year* (SEL 2023) – **in this case, over 100 years around 628,000 tonnes of carbon could be sequestered.**

The initial walkover highlighted that many of the degraded blanket bog habitats while in poor condition would pose few problems were restoration to take place. However, accessing some sites can be problematical in terms of slope, distance from nearest roads, and elevation. This will be discussed in more depth further on in this document.

The species distribution on some sites were noted to be comprised of poorer lichen / bryophyte based habitats that are both fragile and difficult to restore effectively unless clear guidance is

issued to contractors, and sites then managed with experienced surveyors. Although, given the extent of the restoration required it would be advisable to undertake the "easiest to restore" sites first and then with familiarity with site conditions and contractor skill development, the more challenging sites can be followed up in due course.

In terms of designated sites there is a very small area of degraded peatlands within the boundaries of the designated sites on the estate. A review of the *Ben Alder* and *Aonach Beag* site management statement also indicated that: -

"Large numbers of rare and scarce vascular plants, mosses, liverworts and lichens are found at this site, together with some rare invertebrates. The site has been notified as an SSSI for the mosaic of upland habitats and for its assemblages of breeding birds, vascular plants, bryophytes (mosses and liverworts), and lichens.

Ben Alder and Aonach Beag is designated a Special Area of Conservation (SAC) for the range of high-altitude habitats present which include grassland habitats (on both acidic rocks and limestone), montane willow scrub, blanket bog, dry and wet heaths, tall montane herb communities, habitats associated with crevices (in both acidic rocks and limestone), screes, and those associated with cold slow-flowing water."

4. HABITAT DESCRIPTION

The intial desktop survey using landcover Scotland mapping (1988) indicates that in terms of habitats there are 15,961ha with individual components making up areas of : -

- Blanket bog – 2494ha
- Heathland – 9033ha
- Montane – 2095ha
- Grassland – 646ha
- Woodland – 1693ha

Note however that the peat scotland data (ScotGov 2023) is likely to be at a higher resolution (from Satellite data) and currently sits at 2964ha (an increase of 470ha over LCS datasets).

The author takes note that there has been considerable habitat data collection on and around the footprint of the proposed EARBA pump storage hydro project. This was undertaken to both phase 1 and NVC level to enable siting of infrastructure to minimise impacts on valuable habitats as far as possible and to highlight the habitats that are likely to be lost during the construction phase.

Phase 1 habitats

Blanket bog (E1.6.1)
Blanket bog often exhibits a distinct hummock-and-hollow structure, with Sphagnum-rich pools located in the low-lying areas. This habitat category encompasses various subtypes of bog, including watershed mires, saddle mires, terrace bog, valleyside mire, and may incorporate other mire types within a blanket bog complex.

In relatively undamaged instances of this habitat, Sphagnum moss is usually abundant, particularly *Sphagnum papillosum*, alongside other species like *Sphagnum magellanicum*. The hummocks may support a variety of ericoids, including *Calluna vulgaris, Erica tetralix, Vaccinium sp*, and *Empetrum sp*, with *Eriophorum vaginatum, Eriophorum angustifolium*, and *Trichophorum cespitosum* also present. *Calluna* and/or *Eriophorum vaginatum* can dominate large areas, but various species mixtures are possible.

Raised bogs (E1.6.2)
There is only a small patch noted over what was likely a glacial lake sites that has since become filled with peat (NN4518679741).

As a classic raised bog, which is increasingly rare in Britain, the peat layer is several meters deep, creating a distinctive raised dome shape. The central part of the bog has the greatest peat depth, gradually decreasing toward the edges, which have steeper slopes and mark the mire's boundary. Drainage typically circumvents the mire, creating a lagg stream.

The undamaged vegetation in raised bogs closely resembles that described in blanket bogs (E1.6.1). However, when raised bogs are modified through practices like draining, burning, or peat-cutting, they can transform into wet modified bog or dry modified bog.

Basic flush (E2.2)
Again, only a small area was noted (NN5231584624). Typically these flushes usually feature a ground cover of pleurocarpous brown mosses, often without Sphagnum, topped by a noticeable layer of small sedges like *Carex flacca, Schoenus nigricans*, or a blend of herbs. Common pleurocarpous mosses in this habitat encompass *Scorpidium, Campylium, Drepanocladus*, and *Calliergon sp*, while characteristic herbs comprise *Eleocharis quinqueflora, Eriophorum latifolium*, and *Carex lepidocarpa.*

Wet modified bog (E1.7)
This category encompasses altered bog vegetation, typically lacking Sphagnum, often featuring exposed peat and areas of *Trichophorum cespitosum* and/or *Molinia caerulea*. The prevalence of ericoids can vary from abundant to sparse or absent.

This vegetation is commonly found in the process of drying and deterioration on blanket bogs and cut-over raised bogs. It can resemble wet heath (D2) but is distinct due to having a peat depth exceeding 0.5 meters. Vegetation dominated by Molinia on deep peat is classified within this category rather than in marshy grassland (B5).

Dry modified bog (E1.8)
Dry modified bog vegetation is mainly characterized by *Calluna vulgaris* and other ericoids or *Eriophorum vaginatum* on peat deeper than 0.5 meters. Notably, Sphagnum moss is absent, but beneath the dwarf shrubs, there may be a layer of hypnoid mosses, along with lichens like *Cladonia portentosa* and *Cladonia arbuscula*. In cases where *Eriophorum vaginatum* dominates, other species may be scarce or absent. This habitat type, resembling essentially dry heath vegetation or cottongrass moor on deep peat, is commonly found in areas of blanket bog or raised bog that have undergone intense grazing, burning, and draining. This type of habitat is fairly common across much of the West and north west Highlands.

5. NVC

While a Phase 1 was undertaken for the purposes of this survey, an NVC was not, given both time constraints and the nature of Peatland restoration which is to both protect and enhance these habitats. Note also that in general, there has been no historical requirement to include NVC surveys into Peatland restoration programmes.

The key NVC grouping for blanket bog as noted below highlight many of the species groupings that were noted during the walkovers. Notes indicate for each the prevalence, distribution and any constraints around their restoration: -

M15 Scirpus cespitosus/Erica tetralix wet heath – This habitat is noted as being common on degraded blanket bog habitats, and was particulalry in evidence on a number of sites. High-frequency species include *Molinia caerulea, Scirpus cespitosus, Erica tetralix*, and *Calluna vulgaris*, forming mixtures that define the vegetation. *Molinia* is the most

consistent, often abundant, but *Scirpus, Erica tetralix*, or *Calluna* may also dominate. Some sub-communities feature *Erica cinerea, Vaccinium myrtillus,* and *Myrica gale* (only likely where herbivoreage is historically low). Common species are *Potentilla erecta*, with moister areas having *Polygala serpyllifolia, Narthecium ossifragum,* and *Eriophorum angustifolium*, while *Eriophorum vaginatum* is rare. Bryophytes are not common throughout, and Sphagnum species, while present, don't form lush carpets.

This type of habitat while viewed as degraded tends to be easier to restore due the more robust nature of the plants and the root networks that evolve in these habitats.

M17 Scirpus cespitosus / Eriophorum vaginatum blanket mire - This community is found in waterlogged peat areas, and characterized by a mix of plants like Sphagnum species, *Scirpus cespitosus* and *Eriophorum vaginatum*. It can be extensive and uniform or form hummock and hollow complexes which were typically found on the flatter low lying areas across Ardverikie.
It transitions to bog pool vegetation in the hollows. The community is typically less than 30 cm tall and features Myrica gale in some areas (Extensively around the river Pattack). *Eriophorum angustifolium, Narthecium ossifragum*, and *Drosera rotundifolia* are common in wetter spots. *Potentilla erecta* distinguishes it from other Sphagnetalia mires. Other species are present at low frequencies. *Racomitrium lanuginosum* moss is common, especially on hummocks. Lichens, including larger Cladonia species, are associated with *R. lanuginosum*.
This type of habitat can be somewhat challenging to restore given the poorer quality of vegetation structures (Lichens and *Racomitrium Lanuginosum*).

M18 Erica tetralix / Sphagnum papillosum raised and blanket mire - This community is primarily dominated by Sphagnum species, with ericoid sub-shrubs and grasses playing subordinate roles. It can take the form of undulating carpets or include lawn and hummock components. Bulkier vascular plants create a low, patchy canopy, with *Calluna vulgaris, Erica tetralix,* and *Eriophorum vaginatum* being common, while *Scirpus cespitosus* is slightly less frequent. *Erica tetralix* prevails in wetter areas, alongside abundant *Eriophorum angustifolium* shoots, while *Calluna, Scirpus*, and *E. vaginatum* are more common in drier regions.
Sphagnum species are the most significant part of the vegetation, with *Sphagnum papillosum* and *S. capillifolium* being very common, and *S. tenellum* being a constant but less abundant.

Again a slightly more robust community with usually enough vegetative material to ensure that restoration areas are managed to a more effective level.

M19 Calluna vulgaris / Eriophorum vaginatum blanket mire - This vegetation is characterized by a mix of *Eriophorum vaginatum* and ericoid sub-shrubs. While Sphagnum spp. are present over wetter areas, they are not as abundant as in other mire types. The ground is often uneven, but it lacks the distinct hummock and hollow relief. *Eriophorum vaginatum* is a dominant plant species, along with frequent occurrences of *Calluna vulgaris, Vaccinium myrtillus,* and *Empetrum nigrum ssp. nigrum*.

In some areas on Ardverikie, *Vaccinium. vitis-idaea, V. uliginosum*, and *E. nigrum ssp. Hermaphroditum* were noted, but only generally in higher areas with less grassland competition.
Calluna vulgaris is the most common co-dominant plant, but various combinations of these sub-shrubs are common. Few vascular plants are associated with this community, but *Eriophorum angustifolium* and *Rubus chamaemorus* were noted in a few areas during the walkovers. *Deschampsia flexuosa* and *Juncus squarrosus* occur occasionally, and at higher altitudes where historical grazing was high enough to allow them to outcomete other species. The bryophyte flora was however noted to be rich, with *S. capillifolium* being the most frequent Sphagnum species.

The heavy Ericoid composition does tend to favour peatland restoration and a substantial amount of this habitat was noted around the Allt Mhainisteir.

M25 Molinia caerulea / Potentilla erecta mire - *Molinia caerulea* is the dominant species in this community, with a poor associated flora. Common rush species *include Juncus acutiflorus* and *J. effusus*, while *J. articulatus* and *J. subnodulosus* are occasional. The only consistent dicotyledon is *Potentilla erecta*. *Lotus uliginosus, Succisa pratensis, Cirsium palustre,* and *Angelica sylvestris* are sparse, occasionally joined by *Eupatorium cannabinum* or *Filipendula ulmaria*. The presence of *Cirsium dissectum* distinguishes it from the *Molinia caerulea – Cirsium dissectum* mire (M24).
Sub-shrubs like *Calluna vulgaris* and *Erica tetralix* can be quite common. *Myrica gale* is local but can be extensive and dense. Grasses play a limited role, with Agrostis canina and *A. stolonifera* at low frequency, and *Holcus lanatus* being fairly common. Bryophytes are sparse.

Again this community on Ardverikie tended to be notable on gently-sloping ground, marking seepage zones, flushed margins of sluggish streams, water-tracks, and mire systems. Species such as *Myrica gale* tended to predominate due to the historically lower impact of herbivorage.

6. DESIGNATED SITES

The areas noted below are likely to be impacted directly by around **1ha** of potential restoration works (**Map 11**). Restoration even on such a small scale within the designated areas will require close liaison with NatureScot but given that restoration will often occur in similar circumstances it is unlikely to cause any concerns.

Given the diversity of species and habitats across the wider estate are similar to those found within the designated site, any short-term changes to habitats from the restoration process are in most cases felt to be worth it when looked at in terms of longer outlooks.

Close co-operation with NatureScot from the outset will ensure that any sensitivities are effectively managed and if there is any doubt in terms of negative impacts, then restoration outcomes would be guided by the advice of NatureScot ecologists. In any case, there are standard practices noted later in this document that deal specifically with the restoration management of all sites regardless of their designation.

Ben Alder and Aonach Beag SSSI /SAC

Natural features of Ben Alder and Aonach Beag SSSI / SAC: -

Dalradian
Upland assemblage
Vascular plant assemblage

Acidic scree
Alpine and subalpine calcareous
Alpine and subalpine heaths
Blanket bog
Dry heaths Favourable
High-altitude plant communities associated with areas of water seepage.
Bryophyte assemblage
Lichen assemblage
Breeding bird assemblage

Montane acid grasslands Favourable
Mountain willow scrub
Plants in crevices on acid rocks
Plants in crevices on base-rich rocks
Tall herb communities
Wet heathland with cross-leaved heath
Dotterel

Ben Alder SPA

The only bird species noted within the SPA is Dotterel.

Wildland

Wild land areas are the most extensive areas of high wildness. They are identified as nationally important in Scottish Planning Policy, but are not a statutory designation.

There are two areas identified and shown on the attached map: -

- *14. Rannoch - Nevis - Mamores - Alder*
- *19. Braeroy - Glenshirra - Creag Meagaidh*

Species prescence / distribution

Around 1000 species were noted in the review of species identified at Ardverikie through the National Biodiversity Network (NBN) gateway. Of those, 106 birds were noted with 15 species being coded as Schedule 1. So, while all wild birds in Great Britain are protected under the Wildlife

and Countryside Act 1981 (as amended), for any wild bird species listed on Schedule 1, it's an offence to disturb:

- *any bird while it is building a nest*
- *any bird while is in, on, or near a nest containing eggs or young*
- *any bird while lekking*
- *the dependent young of any bird*

The birds identified as Schedule 1 species were: -

Barn Owl	*Crossbill*	*Red-throated Diver*
Black-throated Diver	*Fieldfare*	*Redwing*
Brambling	*Goldeneye*	*Snow Bunting*
Capercaillie	*Greenshank*	*Whooper Swan*
Crested Tit	*Greylag Goose*	*Wryneck*

Mammals included: -

Red Deer	*Eurasian Red Squirrel*	*European Mole*
Eurasian Otter	*Red Fox*	*West European Hedgehog*
Roe Deer	*Sika Deer*	*Brown Hare*
Pine Marten	*American Mink*	*Eurasian Badger*
Wildcat	*Mountain Hare*	*Brown Rat*

Almost 600 species of plants were noted within a 5km from the centre of the estate, including Mosses, Grasses, Herbaceous, Heath species and Bryophytes.

7. PEATLAND RESTORATION AREAS

Restoration
Restoration has been broken into three zones – Primary / Secondary / Tertiary. The area of direct blanket bog restoration amounts to **1031ha** with each proposed restoration area classified as : -

- **Primary– 571ha**
- **Secondary – 392ha**
- **Tertiary – 68ha**

NOTE - ***As previously described (in the summary) the restoration process will physically link up habitats over a much wider area. Initial indications are that this area will likely be up to 1254ha of what are primarily blanket bog habitats.***

Primary restoration zones indicate habitats that generally contains species that are resilient to the restoration process. These can include, *Calluna vulgaris* Ling heather, *Scirpus cespitosus* Deer grass, *Molina / Nardus* grassland and *Juncus squarrosus* Heath rush. In addition these sites are easily accessible, peat depth appears to be appropriate (for blanket bog habitats) and the soil is generally able to bear the weight of excavators without recourse to bog mats etc.
There is also substantial amounts of ancient forest tree roots which make the importation of wood for dams unnecessary.

Secondary restoration zones indicate habitats with variable condition vegetation that may at times lack the requisite plant cover, have poorer access and have soils that may be more difficult to utilise tracked equipment over. There will also be less access to tree stumps for dams and there will likely be more bare areas neccesitating imported brash (heath/grass mix) for cover and seed sources.

Tertiary restoration zones cover a relatively small area, but by extension they also tend to form part of habitats over 600m and therefore one of the most important areas for restoration. Access can be an issue, but even in these areas it is unlikely to impact areas of any noticeable scale.

The principal issues will be herbivore impacts, deep soft peat and the lack of vegetative cover across much of the site.

Poor vegetative cover is usually down to the amount of friable vegetative cover which tends to include higher content of Bryophytes such as *Racomitrium lanuginosum* and lichens (Mostly *Cladonia sp*). These types of habitat are structurally weak and is easily damaged by the actions resulting from the physical restoration process around peatland restoration. This can be circumvented by utilising vegetative cover (usually *Molinia/Nardus* based) away from the damaged habitat, which can often be managed by two excavators operating in tandem to access materials from up to 20-25m from the restoration site.

Deep soft peat in some areas is of particular concern due to the danger of bogging and the subsequent damage to habiats in order to extract machinery. The peat for example around the *Allt Mhuilinn* is particularly deep, with extensive bare areas and a lack of suitable vegetation. It is also likely that part of this site would be at risk of peat slides due to the amount of water (from dams) that might accumulate. What does work in this sites favour is the significant tree stump resource available which when used as dams allows for the development of a porus inundation / stabalisation system, while retaining the sites ability to shed runoff quickly.

Herbivore Impacts may be more challenging to manage in the open range, but where impacts are close to existing woodland areas (or within planned woodland areas), these can be fenced off to facilitate the restoration process and support new woodland regeneration.

Peatland restoration projects are generally facilitated through an open dialogue with the estate before work commences to ensure all parties are in agreement and the restoration process works within the long term management plan for the property.
Close co-operation with the appointed contractor will allow for the micro-management of sites (*both at the pre-planning stage and site management stages*) in order to deal with specific constraints and agree (*potential*) solutions in advance.

Additional desk top survey
An additional desk-top survey was undertaken on 08/11/23 in response to a request to look at additional sections not included in the intial draft of this report.
Around 54ha has been identified as haviing some potential for restoration, (28ha above 600m). **Any areas over 600m will be surveyed in due course**, and areas under 600m will be surveyed as required.

The SLR polygon in **Map 9** has been included to indicate the proximity of restoration to the footings of the dam (SW corner of Lochan na h-Earba).

The polygons in **Map 10** indicate the extent of areas that directly and indirectly benefit from peatland restoration (*through habitat connectivity*). Areas that benefit directly are those that are subject to restoration techniques as outlined in **section 9**.

Habitat connectivity
In blanket bog systems the term "habitat connectivity" refers to the extent to which different areas of blanket bog are connected or linked, allowing for the movement of species within this specific type of habitat. Blanket bogs are characterised by a thick layer of peat, composed of decomposed plant material, and these ecosystems at a basic level are of ecological importance and provide essential services, such as carbon storage and water regulation.

However, in the context of blanket bogs, habitat connectivity can be crucial for several reasons:

- **Species Movement**: Many species, including plants, insects, and birds, may rely on different parts of the blanket bog for various life stages, such as breeding, feeding, or dispersal. Connectivity ensures that these species can move through the landscape, accessing the resources they need.

- **Genetic Diversity**: Connectivity between different patches of blanket bog allows for the exchange of genetic material between populations. This gene flow is important for maintaining genetic diversity within the species, which, in turn, contributes to the overall health and adaptability of the population.

- **Climate Change** Adaptation: Blanket bogs, like other ecosystems, may need to adapt to changing environmental conditions, including those associated with climate change. Connectivity can facilitate the movement of species to more suitable habitats as conditions shift.

- **Ecosystem Function**: Maintaining connectivity in blanket bogs supports the overall functioning of the ecosystem. It can help ensure that ecological processes, such as nutrient cycling and water regulation, occur across the entire blanket bog landscape (Pullin 2007).

Human activities, such as drainage, peat extraction, and land development, have in the past disrupted habitat connectivity in blanket bogs, so conservation efforts such as peatland restoration can play a crucial role in mitigating both historic and proposed impacts. **Map 10** as a visual tool presents habitats that encapsulates the points noted above. These areas will also be underpinned by long-term sustainable land management practices to maintain the health and integrity of any blanket bog restoration.

8. CONSTRAINTS

The key physical constraints usually found on peatland restoration sites are: -

Access
Bird nesting
Time of year (Snow will stop work)
Slope
Habitat type
Peat depth

Other constraints would be investigated as set out in a site specific feasibilty programme (see notes on ***Next steps – peatland restoration***)

9. PEATLAND RESTORATION TECHNIQUES

The primary techniques are noted below and each site will require a range of tailored approaches.

The project design is led from high quality aerials (drone footage), from which mapping is derived and implemented into a working plan. Once completed, the site manager will then take this data and ground truth a range of pre-determined areas.

A working plan will then be formulated that includes:-

- *Reprofiling lengths*
- *Bare area coverage (and where brash might come from)*
- *Dams (stone, wood, vegetation, stumps)*
- *Areas to avoid (watervole, deep channels, watercourses)*

It is crucial to emphasise that during the restoration phase, the contractor will often make on the spot restoration decisions related to slope, runoff, vegetation and availability (in the case of Ardverikie) of stumps for dams. The restoration process is often a reactive one due to the prevailing conditions and the most important component is the experience of the operator and their ability to deal effectively with changes in habitats.

An intial walkover with the site manager and contractor must be undertaken before work commences, and this will usually lead to some changes in the way the site is to be restored.

Weekly visits by an experienced peatland restoration manager will then address any issues as they arise, and these are dealt with on a visit by visit basis. All on-site operators will be spoken to by the site manager on these walkovers, as this builds a strong working relationship and ensures that the same message is fed to all staff.

It will also highlight any concerns early and allows for the rapid implementation of solutions.

In addition, it is now expected that all contractors must capture weekly data on the length of work completed and the positions of any dams etc. This is then checked against the pre-start orthomap and the projected datasets to understand if there are any issues with the contractor data and to identify any discrepancies between projected datasets and actual work completed.

Peatland restoration techniques

Ditch Blocking (Drainage channels)

Man-made drainage channels are blocked at varying distances based on slope angle and width of channel. A "key" is cut out of the drain then large turves are placed in the channel and locked into both sides of the drain walls. This process then stops turf being washed out in heavy rain.

Impacts of Drainage

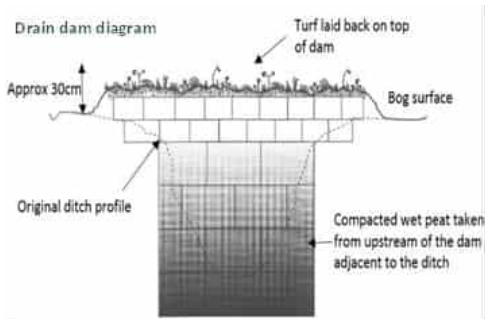
Large areas of the Highlands were drained to encourage the growth of grassland fodder for sheep and cattle in the 1960's and 70's. The detrimental effects of drainage include; -

- *Loss of young birds, including grouse and waders as well as sheep and lambs which fall into, and cannot get out of, steep-sided drains.*
- *Damage to the delicate mosaic of characteristic plant species associated with a diversity of wet soil conditions.*
- *A reduced number of invertebrates, which are used as a food source for a variety of birds.*
- *An increased incidence of flooding and flash flooding caused by greatly increased speed of run-off.*
- *An increase in erosion and silting up of streams.*

Blocking drains – Benefits

Drain blocking helps restore a characteristic community of plants by raising the water level to at, or near, the soil surface, encouraging the colonisation of sphagnum and other specialist plant species. For example bog asphodel, cloudberry, bog orchid and sundew.

Blanket bogs and other mire vegetation communities are of significant conservation value. Drain blocking can provide important feeding habitat for birds. The wet flushes created by blocking grips can increase invertebrate numbers, which provide a valuable food source for grouse chicks as well as wading birds, eg Curlew, Snipe, Lapwing and Golden plover. Cranefly (Daddy long legs) and chironomid larvae (Midge) are particularly important for foraging chicks.



"Wooden dams are an essential component to inundate large areas of bog quickly at relatively low cost" .

Wooden dams

These are generally no more than 2.5m wide and 500mm high. They are used on more active channels where vegetative or peat dams would be washed away.

Timber is usually locally sourced and cut using mobile mills, and is never treated with preservatives.

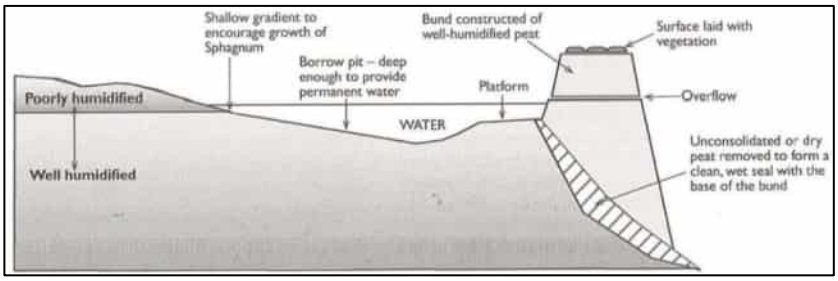
Within 6 months vegetation was starting to grow behind this dam and on this site alone, 35 wooden dams contributed to a reduction of nearly 1000 tonnes per year lost through washouts.

Dams can last 10 to 15 years and are regularly inspected to ensure they are working properly. Their replacement would be supported through a carbon finance management programme.

Peat Bunding

Tends to be used to manage pool systems where there is very little movement across the surface. These can be built from peat as shown in the diagram and topped with vegetation or man-made materials such as hessian jute.

They are an important tool in managing large bare areas as they are quick to emplace using excavators with specialized tilting bucket systems.



Stump dams (below)

In the case of Ardverikie there are substantial areas of remnant forest tree stumps. These can form an integral "anchor" for small, vegetated dams (shown below) and serve as a tool to slow, rather than impound runoff. This reduces the use of imported timber and crucially lessens disturbance within restoration zones.

EQUIPMENT

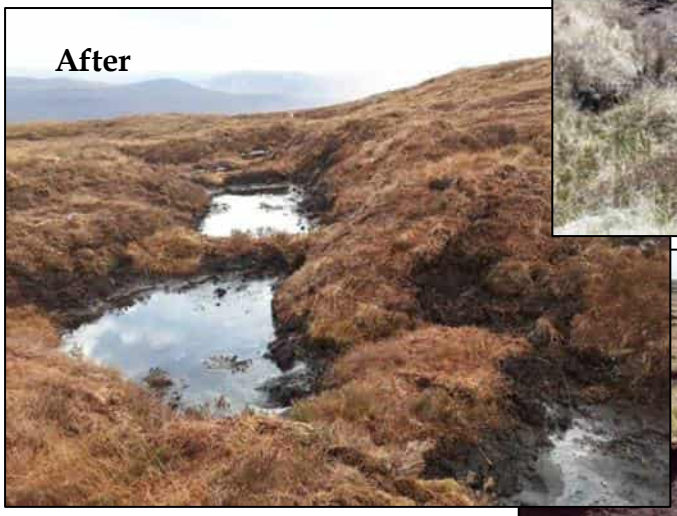
Specialised machinery is essential for accessing sites that are in some cases incredibly remote with highly sensitive habitats in-between.

Access routes can also be impacted by vehicles and sites are often allowed to rest between restoration programmes so that tracking doesn't have long term impacts on fragile upland ecosystems.

Sites such as the one below are typical of degraded habitats that lie at altitude, with no obvious routes in, and can only be accessed by low ground pressure vehicles or on foot.

REPROFILING

REPROFILING is the most important tool in our toolbox. This technique accounts for 90% of the work carried out on site and while it is fairly simple to demonstrate, the execution requires considerable skill and an inherent ability to read the landscape.



OPERATORS work sympathetically with the landscape to rework eroded banks into more resilient habitats. Banks are realigned to around a 30° slope and covered where possible with vegetation from surrounding habitats.

Operators "stitch" in areas that they have taken vegetation from as it's essential that these surrogate habitats are protected from drying out.

Using 8 tonne excavators with "tilty" hitches, operators effectively have a mechanical wrist that can rotate to different angles and allow them to reach into every corner of the habitat.

WITHOUT restoration, even habitats of around 150ha can leach over 1000 cubic meters of carbon and sediment into watercourses annually, impacting biodiversity and climate change at all levels.

10. NEXT STEPS (PEATLAND RESTORATION)

The following processes outline the current approach to peatland restoration utlising peatland action funding. Whilst some of the following will not be required as part of the agreement with Ardverikie / EARBA, other elements such as planning permission and a CDM are legal requirements. This would be dicussed with stakeholders at the appropriate point and then actions agreed as a result.

The Peatland restoration process to date in Scotland has been underpinned by public finance through the Scottish government and its funding body – Peatland action.

Many projects are also subject to conditions and guidance provided through the IUCN (International Union for the Conservation of Nature) and its Carbon code.

Current guidance from both bodies indicates that the basic process to deliver a peatland restoration programme involves the development of a feasibility document that lists (but not limited to): -

- *Site survey to record basic condition (to peat code standard) – Near natural / Modified / Drained / Actively eroding*
- *Peat depth survey is always required at 100m intervals and down to 50m in some instances – additional data is collected including condition and pictures at each plot.*
- *Habitat impact survey (herbivore impacts) – usually to HIA (Habitat Impact Assessment) level*
- *A CDM is required (standard peatland action format can be used in absence of suitable document)*
- *Permission is sought from Scottish Water if site is within a drinking water catchment*
- *A Prior notification agreement is required from the appropriate planning body*
- *NatureScot are consulted for permissions around bird nesting, designated sites and the prescence of iconic species such as Golden Eagle, Sea Eagle, Osprey, Black grouse, Capercaille etc.*
- *Work being undertaken during bird nesting season is overseen weekly by an independent ornithologist who will issue advice in line with the species present.*
- *A review of any utilities that may be within the access or restoration zone*
- *A review of any Historic sites that may be within the access or restoration zone*
- *A Peat slide risk is carried out using desk top tools usually, but if particular risk is identified then it can progress to a site engineering review by qualified individuals (recommended for site at NN 53631 86688).*
- *A review of any constraints around prior legal agreements around hydro, windfarms etc.*
- *A review of access issues in terms of habitats, slopes etc.*
- *Costs associated with restoration of access routes and roads.*
- *Drone derived orthomaps to ensure the highest possible detail to support the digitisation of the restoration – this is crucial in developing a tender as the digitisation provides all the required information on lengths of restoration, bare areas and herbivore tracking.*

In addition: -
Given the difficulty and fragility of blanket bog habitats it is essential that an experienced contractor is chosen for any restoration projects and that each project is overseen by an experienced site manager.

Particular habitats can cause long term issues due to current habitat fragility, size of bare areas, depth of channels, water flows, slopes and herbivore impacts. Therefore steps should be taken to mitigate any issues with a thorough intial pre-start review with the selected contractor to identify constraints and manage expectations.

On some areas, extra materials will be required such as wood for dams and brash (a mix of heather, grass and sphagnum) to cover bare areas. Some thought will be required as to how these materials are sourced and then moved to and around a restoration site.

Some sites that are suitable for restoration may well currently be heavily impacted by herbivores (usually red deer) and consideration should be given to deer fencing and selective culling (on specific areas). However this should be considered carefully as it can impact migration pathways and lead to negative impacts on other habitats (usually trampling). It can also lead to traditional grazing areas being fenced off leading to potential long term welfare issues for the hefted deer population. Ardverikie estate are best placed to identify any concerns in this instance, and would therefore be fully consulted (and have the final say) if this were to be considered.

Peatland restoration projects can be undertaken at any time, however some constraints can slow or halt progress. Snow at more than 2 or 3cm is enough to halt progress and very dry weather can also inhibit the spreading of vegetative material (dry turves become very resistant to ease of spreading). Note that given the requirement to undertake a substantial amout of restoration over 600m, then it is advisable that these be commenced either in spring or autumn to maximise the opportunities to extend the working season.

Weather conditions can also lead contractors to (on occasion) remove equipment if snow conditions persist and this can lead to lengthy delays in reintiating projects once weather condtions improve. Primarily this is due to lack of compensation payments due to weather related downtime.

11. ADDITIONAL APPROACHES

Current peatland restoration practice is underpinned by two significant approaches

Peatland action
At the heart of peatland restoration practice in Scotland is Peatland action. Since 2017, they have supported, advised and funded virtually all peatland restoration in Scotland with access to a fund of £250 million.
Through a process of close co-operation with land owners/managers, contractors and key stakeholders like SEPA and Scottish water a techical compendium (PA 2023) was released in 2023.
This document is the primary tool for site managers and contractors to decide on appropriate restoration techniques on sites across Scotland.
In the case of Ardverikie, this would provide a basis for discussions on suitable techniques across the estate.

Peatland code
The Peatland Code is a voluntary certification standard for UK peatland projects wishing to market the climate benefits of peatland restoration and provides assurances to carbon market buyers that the climate benefits being sold are real, quantifiable, additional and permanent. Organic Farmers & Growers (**OF&G**) assess what we do though ISO 14065 (*The international standard for greenhouse gas validation and verification*).
The three primary processes are **Registration, Validation and Verification**

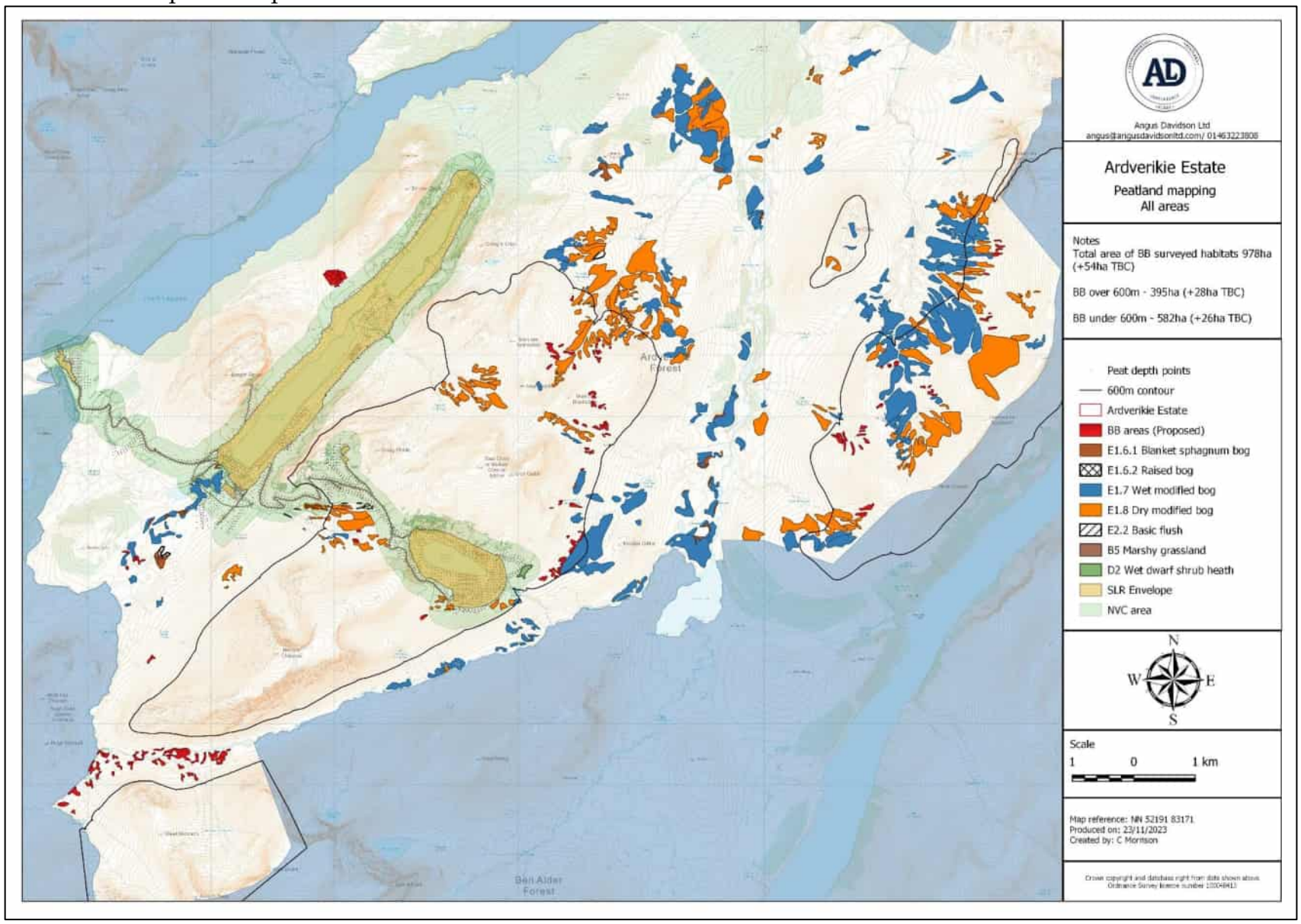
Registration - The Peatland Code Registry provides an open and transparent record of projects through the International Union for Conservation of Nature (IUCN).
In addition, we register our projects on **IHS Markit** – A global Environmental Registry platform that creates a more accessible '*one-stop-shop*' for woodland and peatland carbon schemes under the umbrella of the UK Land Carbon Registry.

Validation - Predicted GHG emissions reductions are checked against the requirements of the Peatland Code and it's then determined if implementation of the project plan will result in the GHG emissions reduction asserted.

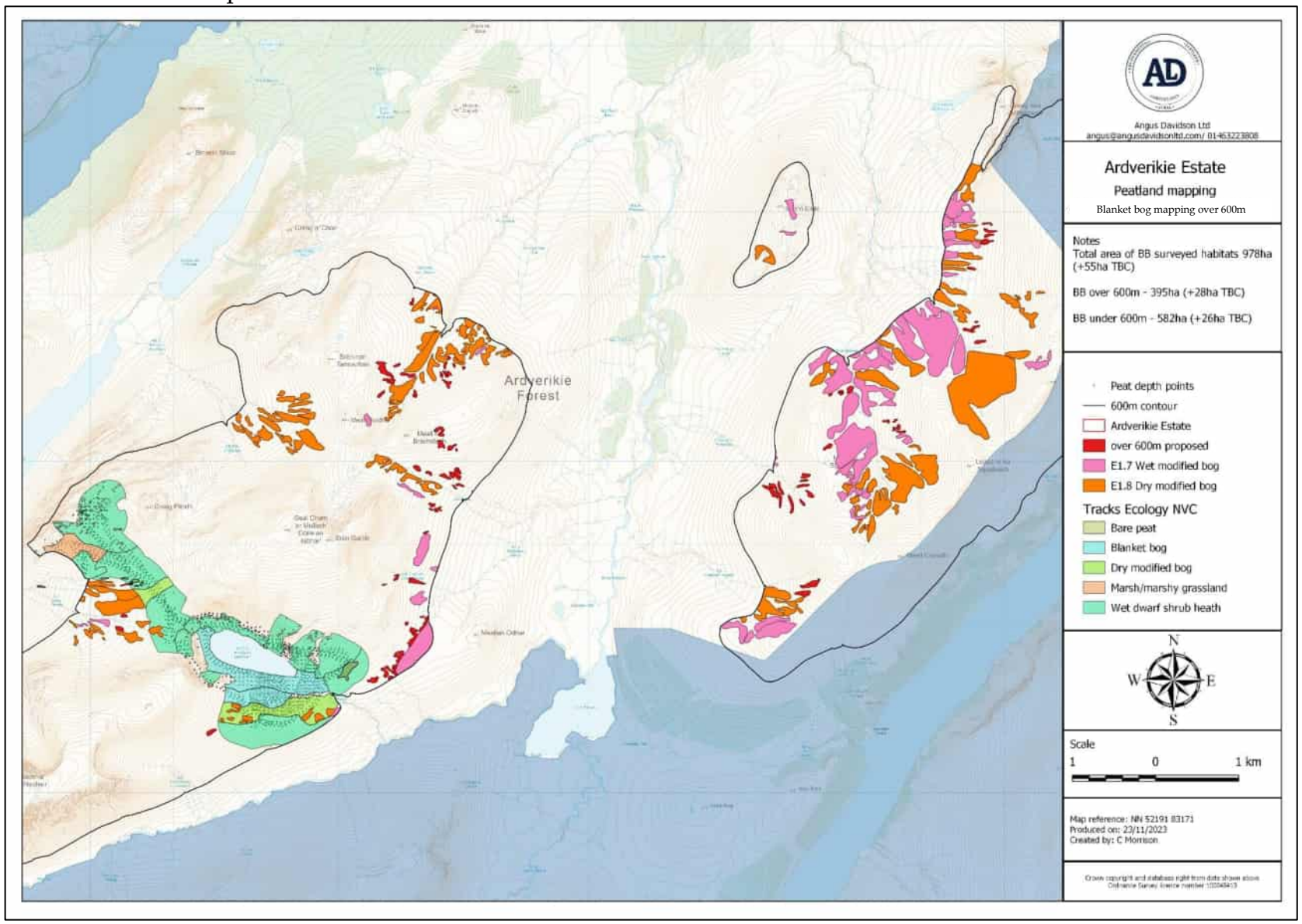
Verification – This is the process that regularly evaluates a project and its actual GHG emissions reduction against both the requirements of the Peatland Code and its validated project plan and GHG assertion.

From a practical standpoint the Peatland code offers a range of tools to quantify peatland degradation and advice on techniques to successfully restore peatlands.
It also gives landowners/stakeholders external verification/validation tools to look at restored areas on an ongoing and regular basis to ensure compliance with current standards.

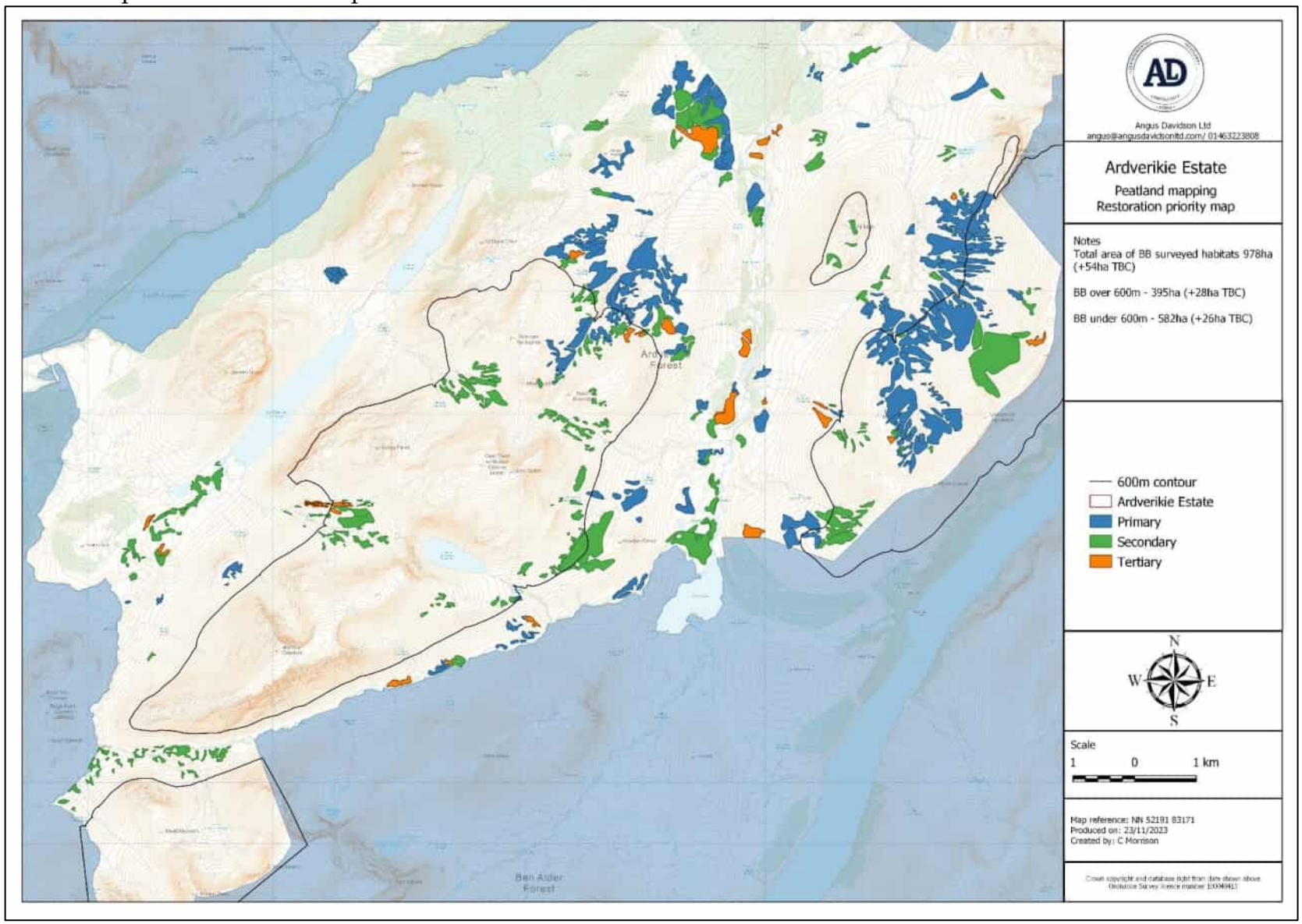
Map 1 - Ardverikie potential peatland restoration areas



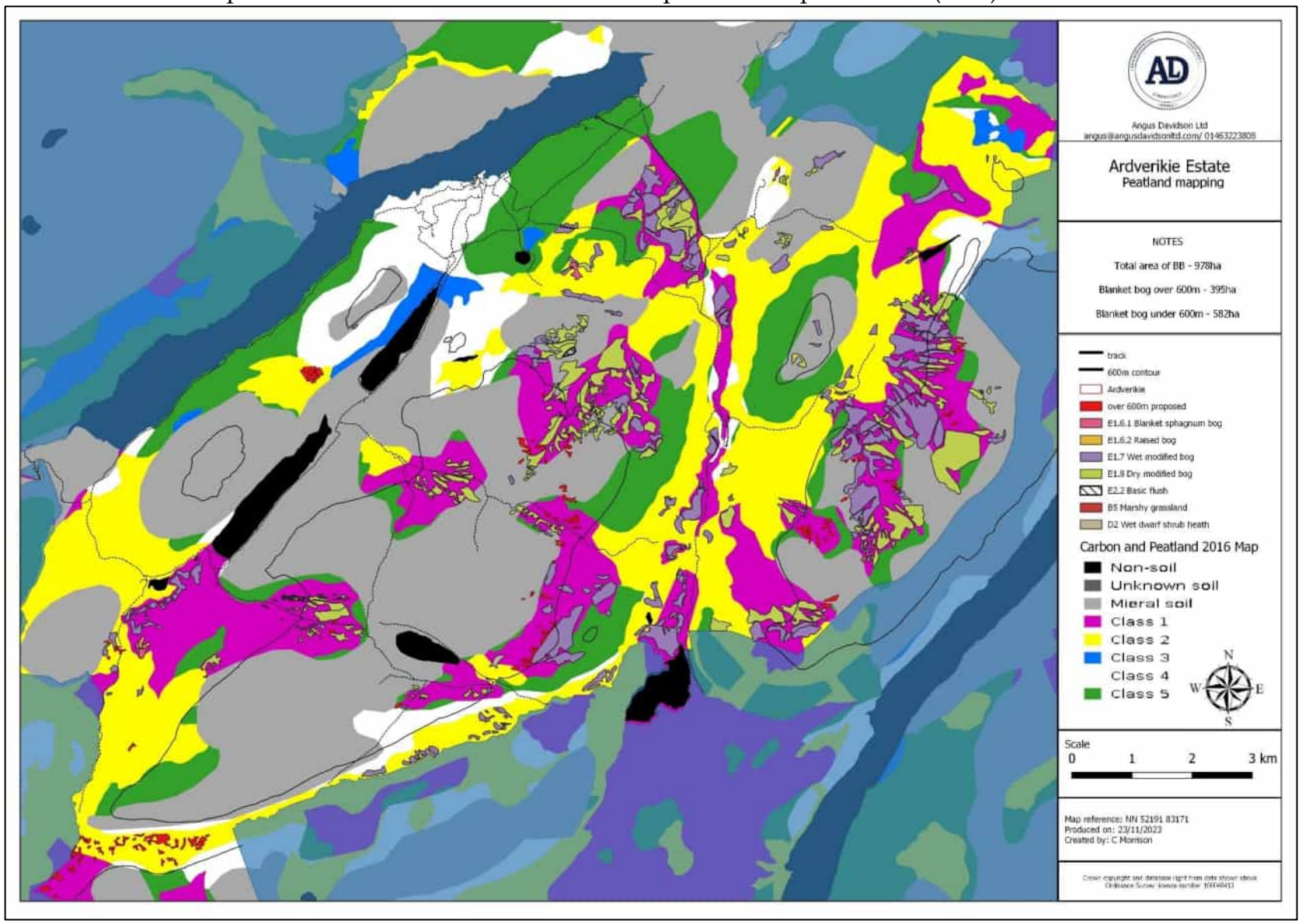
Map 2 - Ardverikie Potential peatland restoration areas over 600m



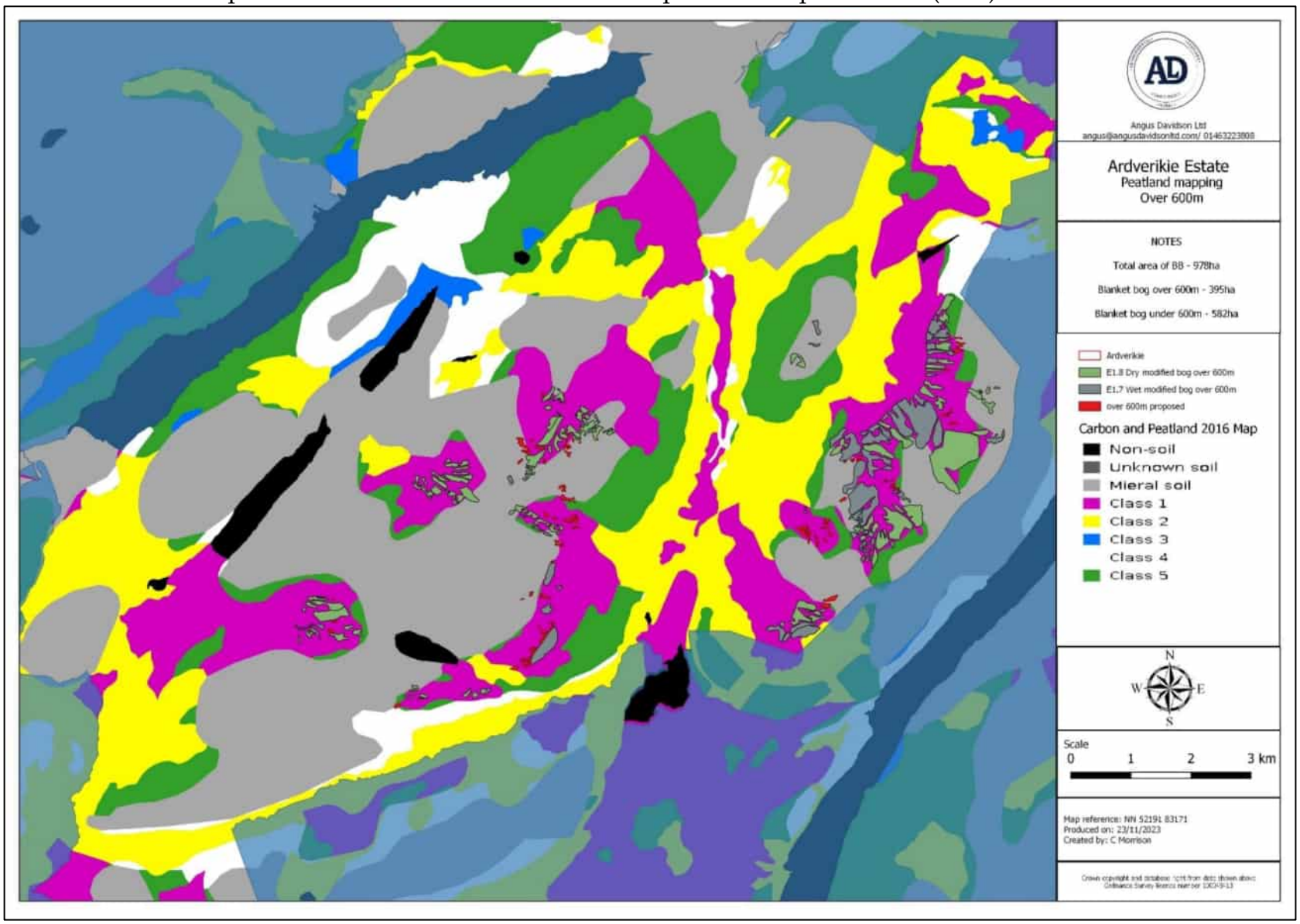
Map 3 - Ardverikie peatland restoration potential



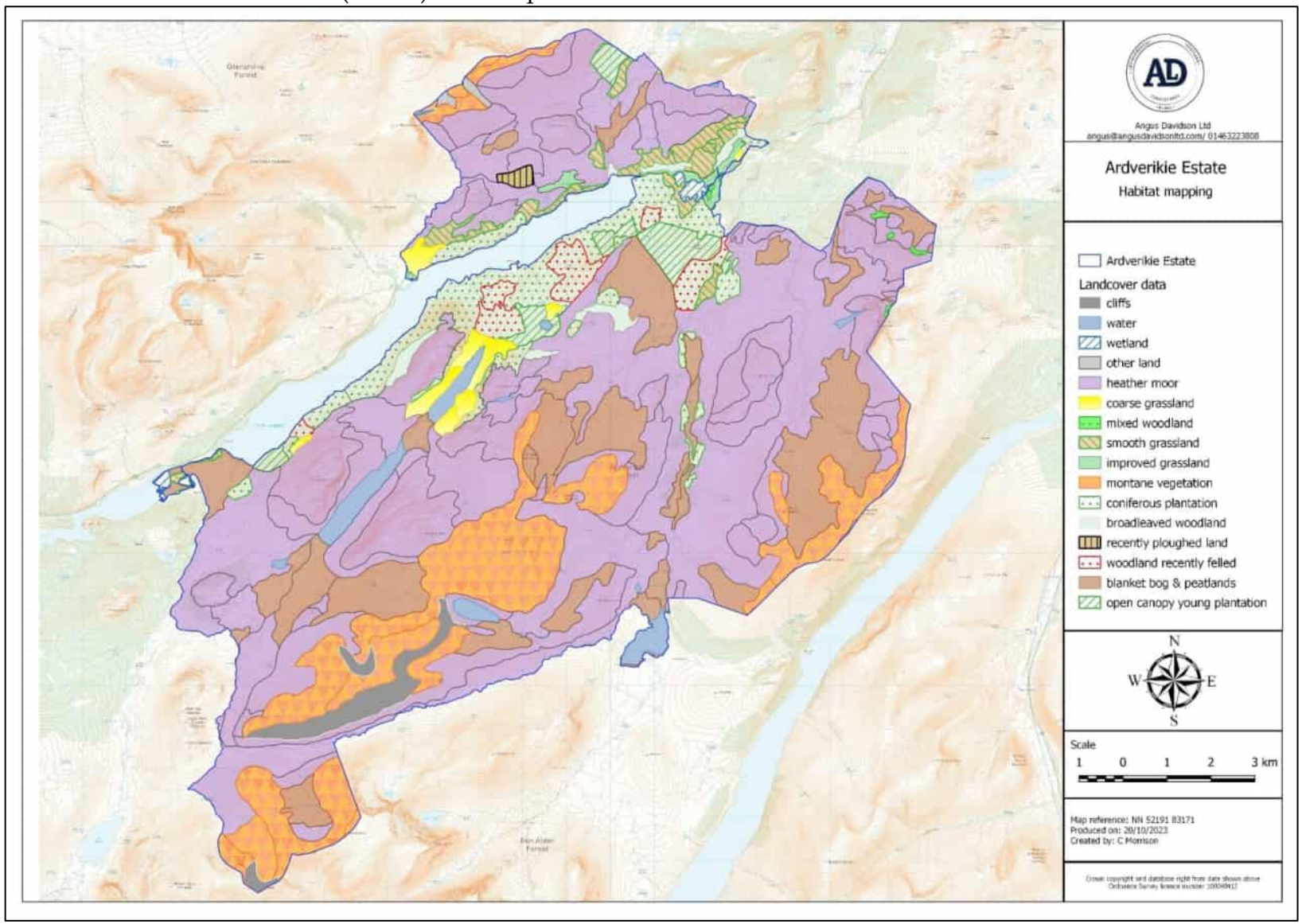
Map 4 - Ardverikie Potential peatland restoration areas with Carbon peatland map condition (2016)



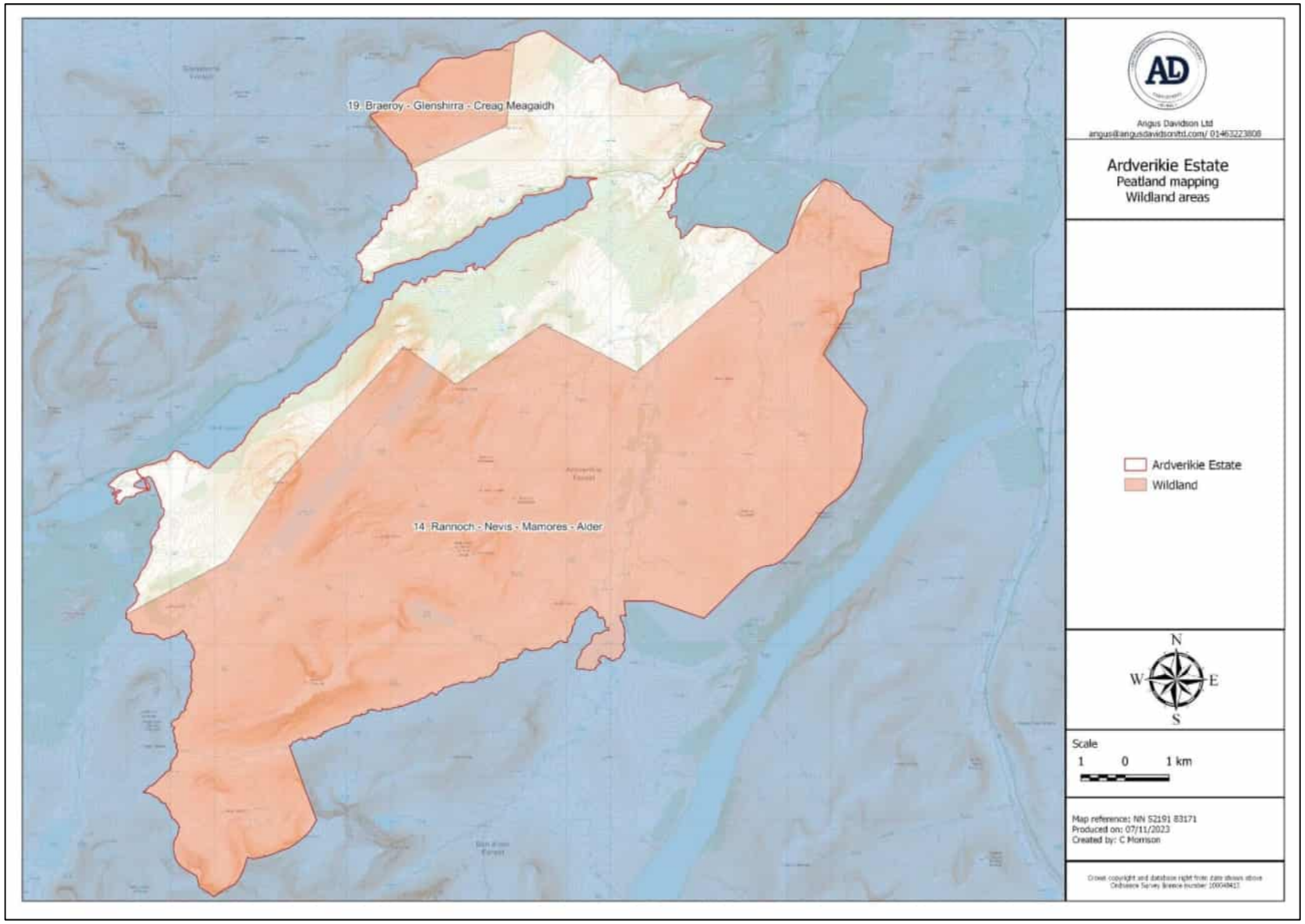
Map 5 - Ardverikie Potential peatland restoration areas with Carbon peatland map condition (2016)



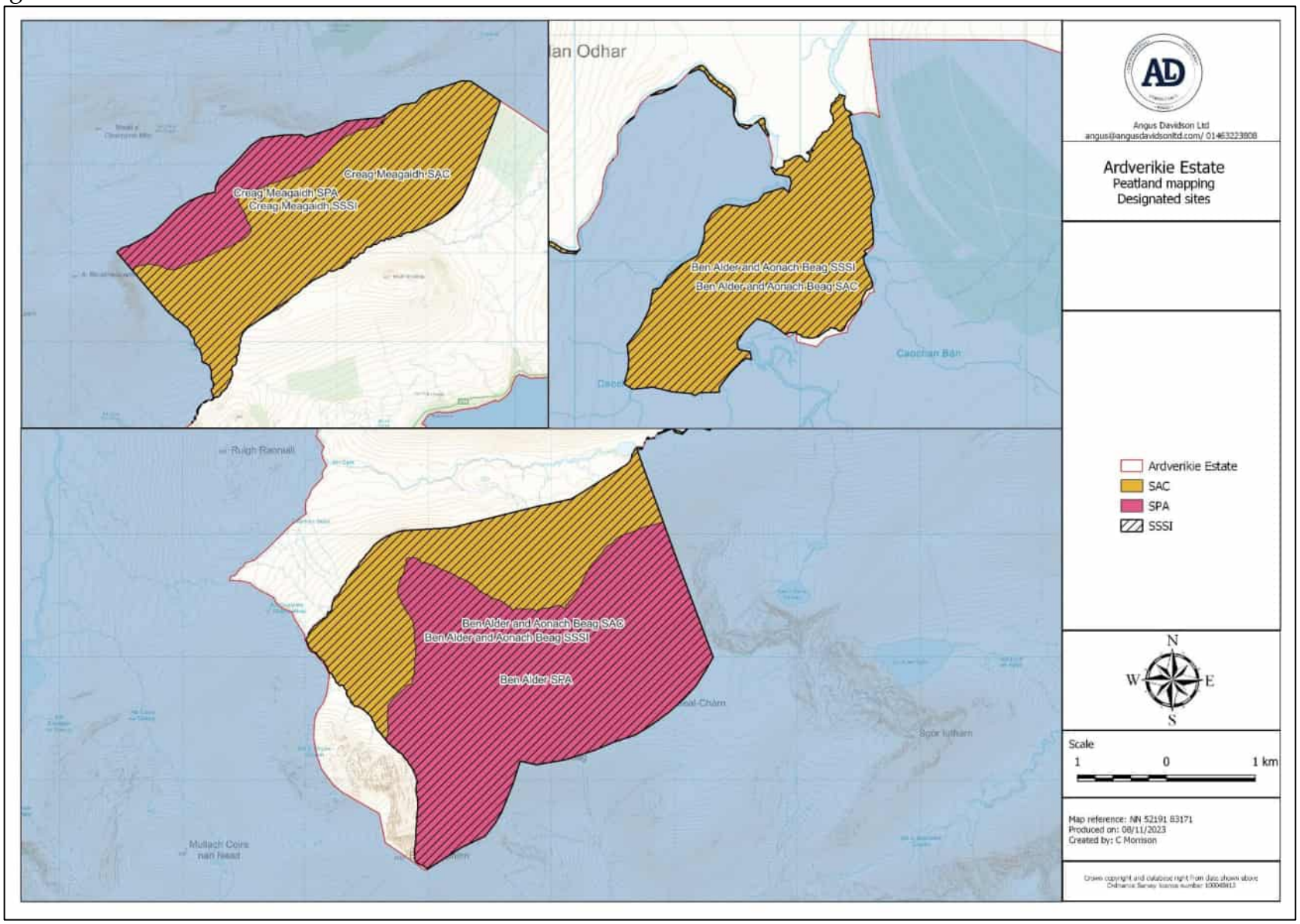
Map 6 - Ardverikie Landcover Scotland (LCS88) data map



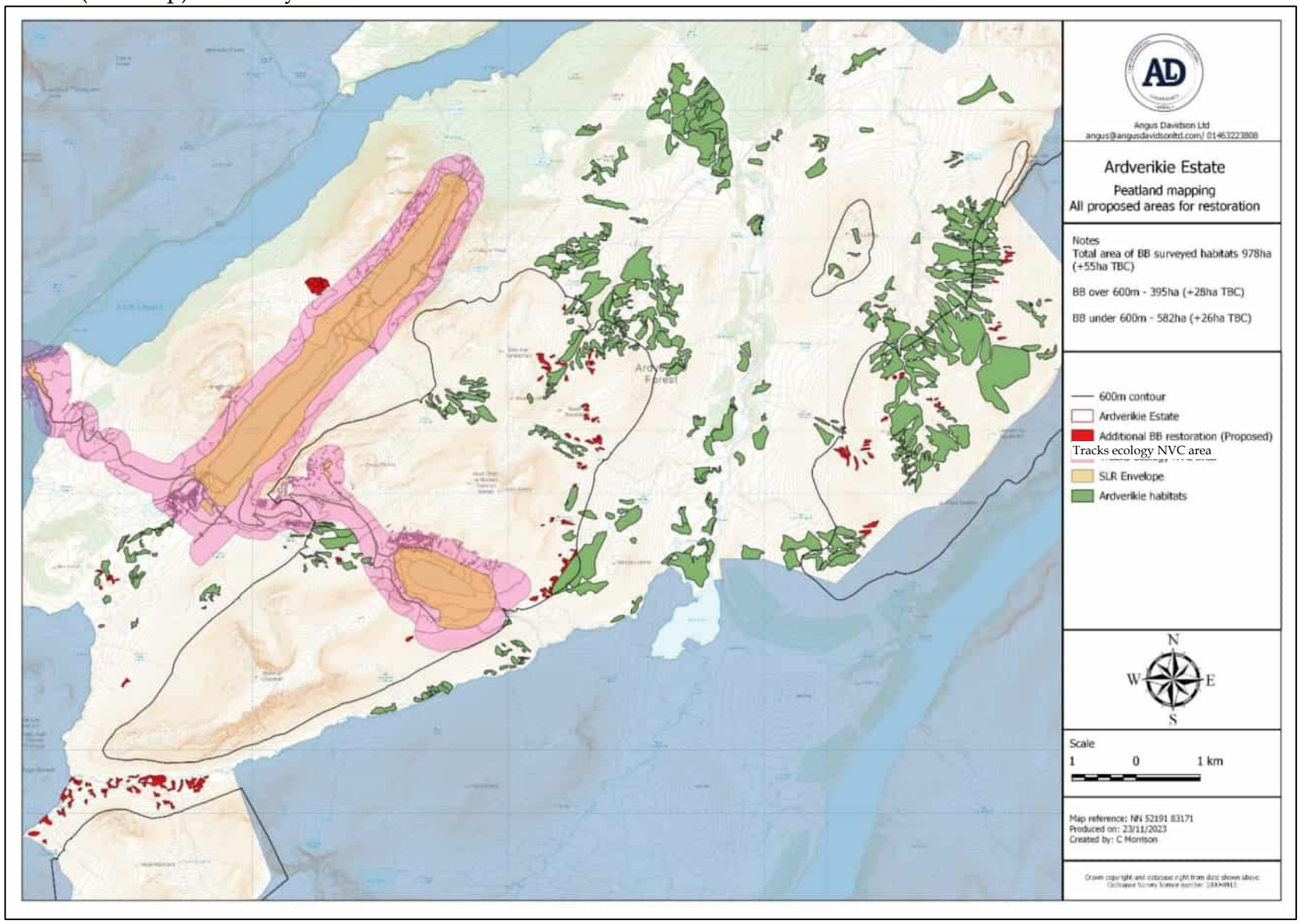
Map 7 - Ardverikie Wildland areas



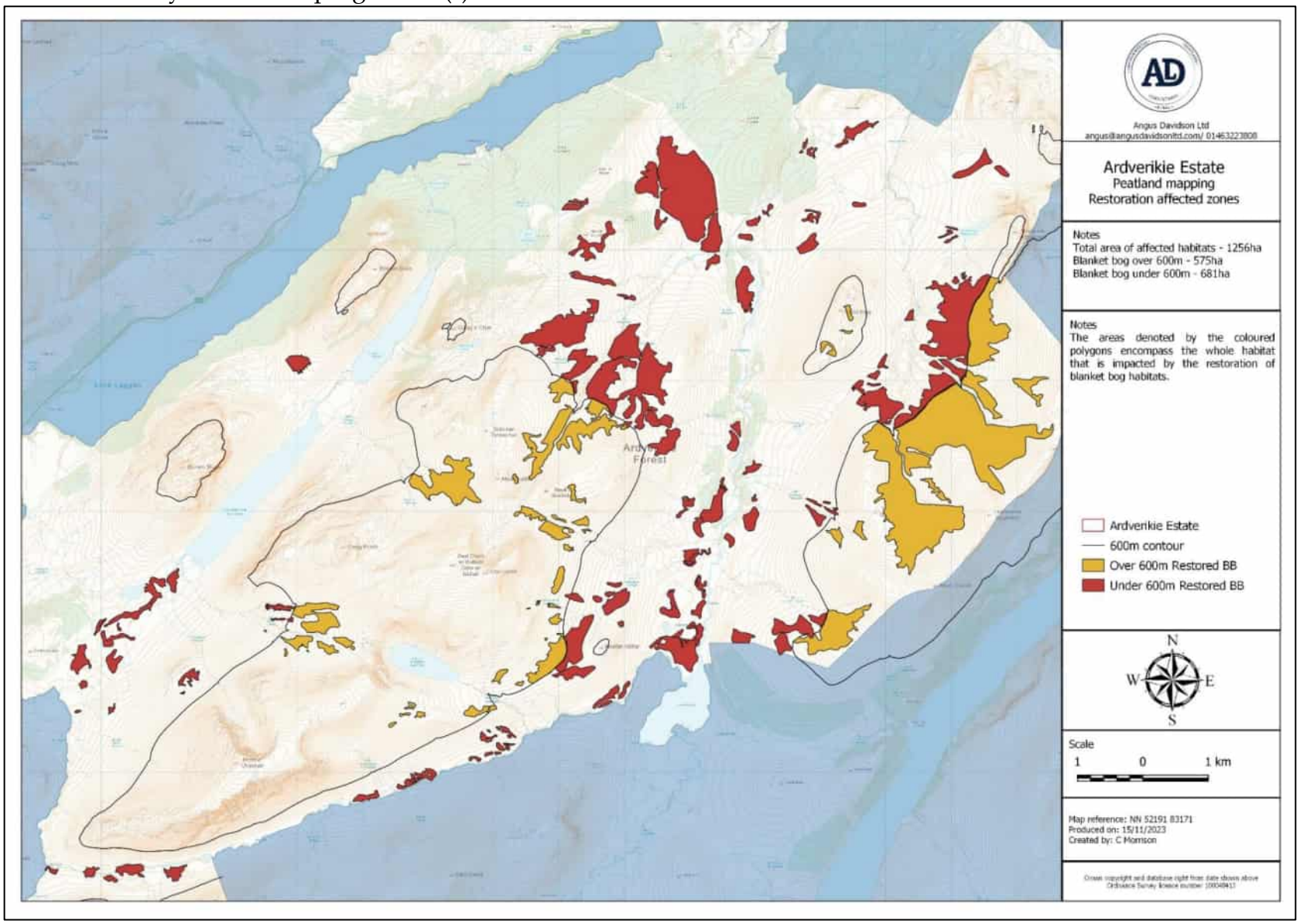
Map 8 - Designated sites



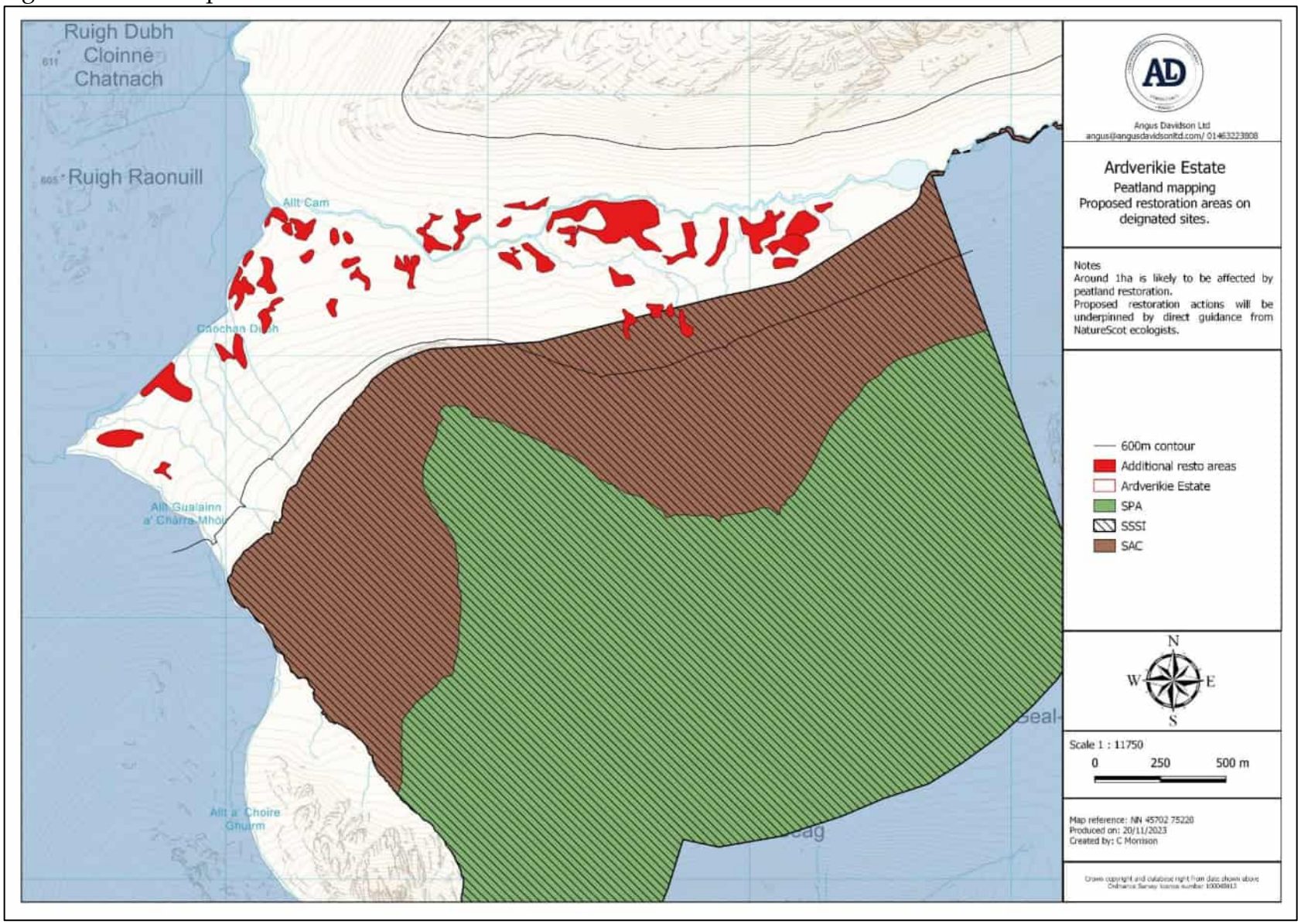
Map 9 - Additions (desk top) to surveyed areas



Map 10 - Areas enhanced by restoration programme(s)



Map 11 - Designated sites and potential restoration areas



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<https://www.scotlink.org/species/blanket-bog/> (16/11/23)

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Appendix 8.6.2 Loch Earba PSH Biodiversity Planning and Deer Management Information Note (Victor Clements)

EIA APPENDIX 8.6: Outline Biodiversity Enhancement and Management Plan

Earba Pumped Storage Hydro Scheme

Earba Limited

SLR Project No.: 428.013028.00001

28 February 2024

Gilkes Energy

LOCH EARBA PSH DEER MANAGEMENT PLANNING ADVICE

FEBRUARY 2024

Image from SNH helicopter count 2011 for Mid West Deer Management Group

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The Native Woods Co-operative (Scotland) Ltd is a non profit distributing organisation dedicated to managing and expanding Scotland's native woodlands. We offer specialist advice and management services to landowners and agents throughout the country.

Contents

EXECUTIVE SUMMARY

The purpose of this document is to set out how deer will be managed with a view to implementing an extensive habitat restoration programme on Ardverikie Estate, to mitigate any degradation of habitats arising from the Loch Earba Pumped Storage Hydro (PSH) scheme, and to allow for clear overall Biodiversity Net Gain.

Initial proposals centred primarily on the restoration of blanket bog and peatland habitat (**Option A**). This plan has however been adjusted by replacing a proportion of the possible peatland restoration (23 percent or 188 ha) by a much more extensive native woodland restoration scheme (**Option B**), which would cover the three mountain tops of Binnein Shuas, Binnein Shios and Creag a Chuir in a large 1500 ha enclosure around the new enlarged loch, as well as retaining 625 ha of peatland restoration on the open hill. Such a scheme will diversify the range of habitats being restored, and firmly tie in the restoration of the two mountains after which the new dams will be named.

The outputs of this plan on the open Ardverikie hill will be:

- 625 ha of peatland and blanket bog restoration.
- A reduction of deer density from 13.2 deer per sq. km to 8 deer per sq. km over four years. This equates to 700 animals or 39 percent across the estate.
- Arising from this, the proportionate browsing reduction on 11,390 ha of largely heath dominated plant communities in the wider landscape.

Outputs within the enclosed area will be:

- The restoration through removal of grazing of 65 ha of ancient woodlands, and a further 103 ha of LEPO (Long established of Plantation Origin) pinewoods.
- Beyond this, a minimum 100 ha of native woodland natural regeneration
- The planting of 60 ha of birch/ willow dominated woodland at conventional spacing.
- The planting of 200 ha of low density native woodland on the intermediate slopes of Binnein Shuas and Binnein Shios.
- The planting of 200 ha of low density montane willow habitat across the three mountain tops.
- The additional planting of 68 ha of native woodland as screening/ landscaping at key areas around the scheme infra structure.
- A number of other outputs set out in initial biodiversity plan, including the removal of invasive rhododendrons, and other species specific conservation actions.

In addition, the scheme will improve the hydrology of the main watercourse arising from the new resevoir by increasing its flow.

The effective restoration of three mountains, in addition to 625 ha of peatland restoration and reduction of browsing in the wider landscape provides for Biodiversity Net Gain on a very large scale, with strong certainty of outcomes, while still retaining some of the deer stalking history and culture of the estate. This proposal is fully supported by the Applicant, Ardverikie Estate and its staff, and all the professional advisors involved in this process. It is a logical and practical plan, on a large scale.

Document Design & Option Rationale

This document is presented as an information note. The deer management necessary to deliver the scheme will depend very much on the biodiversity and habitat enhancement actually proposed, with different approaches having different implications on what might be required.

The note sets out the evolution of thinking, and how that has changed from a largely peatland only restoration plan **(Option A)** to a plan which still includes a large peatland area, but which also includes a very significant woodland restoration element **(Option B).**

This option has evolved for the following reasons:

1. It removes areas of peatland which are likely to carry much more inherent risk in their restoration, and therefore the certainty of a good outcome is much higher.
2. The extensive woodland restoration plan diversifies the range of outcomes to be delivered, and woodland may be viewed by some as being more tangible in the landscape. A wider diversity of outputs will therefore be delivered.
3. It incorporates and links to the most important ancient woodland areas on Ardverikie, and takes in the large areas of Scots Pine woodland which will obviously regenerate very well if they are given the opportunity to do so. Any restoration scheme, so close to such woodlands, could not omit them from an enhancement plan. A woodland option is therefore too obvious to ignore.
4. It provides the opportunity for effective restoration of montane habitat, across three mountain tops.
5. Deer management planning can be undertaken with a greater degree of certainty, across both open ground and enclosed habitats.
6. It incorporates the two mountains after which the new dams will be named.

A third option **(Option C)** was considered, which involved a significant restoration project on the Aberarder part of Ardverikie Estate, which lies to the east of the Nature Scot owned and managed National Nature Reserve at Creag Meagaidh. However, while the deer management required would have been much easier in that location, it was felt that the same diversity of outcomes could not be achieved, and the area is also detached from the new hydro scheme development itself.

Option B, which is the Ardverikie Woodland or Three Mountains option, is the one which is unanimously endorsed by all those involved with the project, and is the scheme that is being proposed to mitigate any loss of habitats due to construction, and to demonstrate very obvious Biodiversity Net Gain.

Introduction

This information note has been prepared for Gilkes Energy to help inform their biodiversity/ land management planning in relation to the large pumped storage hydro electric scheme they are planning to develop on Ardverikie Estate beside Loch Laggan, on the boundary between Lochaber and Speyside.

The scheme being developed, known as the Loch Earba Pump Storage Hydro, will be the largest of its kind in the UK, and an essential part of our national energy infrastructure. The scheme will use excess energy at times of low demand to pump water to a higher level, releasing it again to generate power at times of higher demand. It will in effect be acting as a giant rechargeable battery, allowing the National Grid to better manage electricity generated by renewables in the north of the country, and transmitted by the Beauly- Denny power line.

Although the footprint of the overall development is relatively small, the infrastructure footprint and reservoir inundations will cause the loss of an area of natural and semi- natural habitats, and this will need to be mitigated by enhanced management of habitats elsewhere, to allow for suitable compensation, and to deliver biodiversity net gain.

Very extensive survey of the development area has been undertaken by Tracks Ecology, with woodland evaluation undertaken by Helge Hansen.

On the back of this, SLR Consulting Limited have been commissioned to produce an Outline Biodiversity Enhancement and Management Plan (OBEMP), with specialist peatland restoration advice being provided by Angus Davidson Ltd (ADL). Ongoing discussions have been conducted with Nature Scot and Highland Council in relation to biodiversity enhancement.

Communications and development work to date have been accessed in order to prepare this information note on deer management.

Victor Clements is a native woodland advisor based in Aberfeldy in Highland Perthshire. He is secretary/facilitator to four deer management groups, advises others, and specializes in deer management planning and native woodland regeneration schemes.

Biodiversity Planning

Between water inundation and construction of essential infrastructure, it is likely that approximately 310 ha of natural habitats will be permanently lost and another 103 ha temporarily or indirectly affected, and this will need to be mitigated. Beyond this, SLR Consulting Limited have been tasked with developing a plan which shows clear biodiversity net gain overall.

The habitats that would be lost comprise mostly wet heath and blanket bog, with small areas of a range of other open ground habitats, and approximately 7 ha of native or semi- natural woodland. The detail on all this is covered in other reports and is not repeated here.

National guidance allows that Biodiversity Net Gain can be delivered in one of two ways:

1 A metric approach in which restored habitats are required to be an agreed multiple of those lost, e.g. 1 ha of habitat lost might require 10 ha of similar habitat restored, or 1:1 in other cases
2 A more bespoke approach to compensation and enhancement.

SLR Consulting Limited initially advised the latter option, and had developed a plan which would potentially involve the restoration/ improvement of 813 ha of blanket bog/ peatland, and approximately 68 ha of woodland creation. This is referred to later in this document as **Option A**. The 813 ha of direct restoration proposed represents a 11:1 lost/degraded to restored ratio (423 ha above 600m, 390 ha below 600m). The full extent of degraded peatland identified by ADL is 1,031 ha (which includes primary, secondary and tertiary areas of restoration potential). The recommended ratio for native woodland is 1:1, so the 68 ha of new woodland creation represents an obvious net gain over the 7 ha lost.

The original OBEMP dated 23rd November 2023 overview also includes proposals for deer reductions across the wider estate which are expected to benefit heathland and other open habitats more widely, as well as a number of other measures, including aquatic enhancement and species-specific measures. A deer reduction of nearly 40 percent is now planned.

In terms of deer management, the area of new woodland is easily accommodated as this will be fenced, but the areas of proposed peatland restoration are located right across the estate, and will therefore require adjustments to management at that level at least, and this is likely to affect neighbouring properties as well. The distribution of peatland can be noted in Appendix 6 to this document.

Correspondence between the development team and Nature Scot has also raised the presence of vulnerable montane habitats within the development envelope, including small areas of montane willows, and that could have a significant bearing on what deer management provisions are required, depending on how this is addressed.

This document considers what changes to deer management might be required to facilitate the delivery of the 813 ha of proposed peatland restoration and modest woodland planting, as proposed by SLR Consulting Limited. It seeks to quantify the consequences of any variations to this, and does indeed suggest a significant variation to the proposed plan (**Option B**) which is still recognizable from that suggested above, but which would also deliver some of the montane habitat improvements that might be required. A third option is also suggested, but only in principle as there is little data to go on there as yet, and this would slow the timeline of any application.

It is important to note from the outset that the required deer densities to deliver successful peatland restoration will vary according to (1) site location in relation to other habitats, (2) altitude, (3) restoration techniques used and (4) extent within the landscape. There may be other local factors to consider as well. While a range of informed opinion can be sought, what is actually required will be subjective and difficult to predict with any real certainty, so ongoing monitoring and adjustments

will be necessary, and checks and balances agreed at the outset. There is no off-the-shelf guide density that might satisfy the whole, and it is important that this is understood as part of the planning process.

Risk assessment is also essential, it being important to choose a range of locations and techniques where the chances of successful restoration are high. The higher the risk of restoration being unsuccessful, the lower any deer density will have to be.

Deer Management Planning on Ardverikie Estate

Included with this document are a range of attachments:

*Excel spreadsheets are noted in **green***

*Word/text documents are noted in **black**.*

*Restoration Options are listed near the end of the document in **red**.*

These documents are not embedded in the report but included as attachments, with the colour noting the document type.

There are no hill sheep on Ardverikie or any of the neighbouring estates in the eastern sub group of the Mid West Deer Management Group area, so red deer are the only significant herbivore within the hill area, although modest numbers of mountain hares may also be present. This greatly simplifies our understanding of the dynamics involved, and how impacts might be managed.

Roe and sika deer are present in woodland areas on the estate, but these will not impact on the hill area. Occasional wild boar are present within the area, and these might be expected to increase in the future. Roe, sika and wild boar are important considerations from a woodland perspective, with their ability to colonize new woodland areas by breaking through fences. There are no feral goats within the area.

Ardverikie is a long standing and key member of the Mid West Deer Management Group (MWDMG). Background information on the group can be found at: https://midwestassociationdmg.deer-management.co.uk/deer-management-plan/ with the deer management plan having been recently updated to cover the period 2023-28. This can be adjusted as/when required to accommodate the Loch Earba PSH project. The plan is designed to be flexible as to developing projects within the area.

Ardverikie Estate can be noted on the map in Plate 1 below, in the northeast corner.

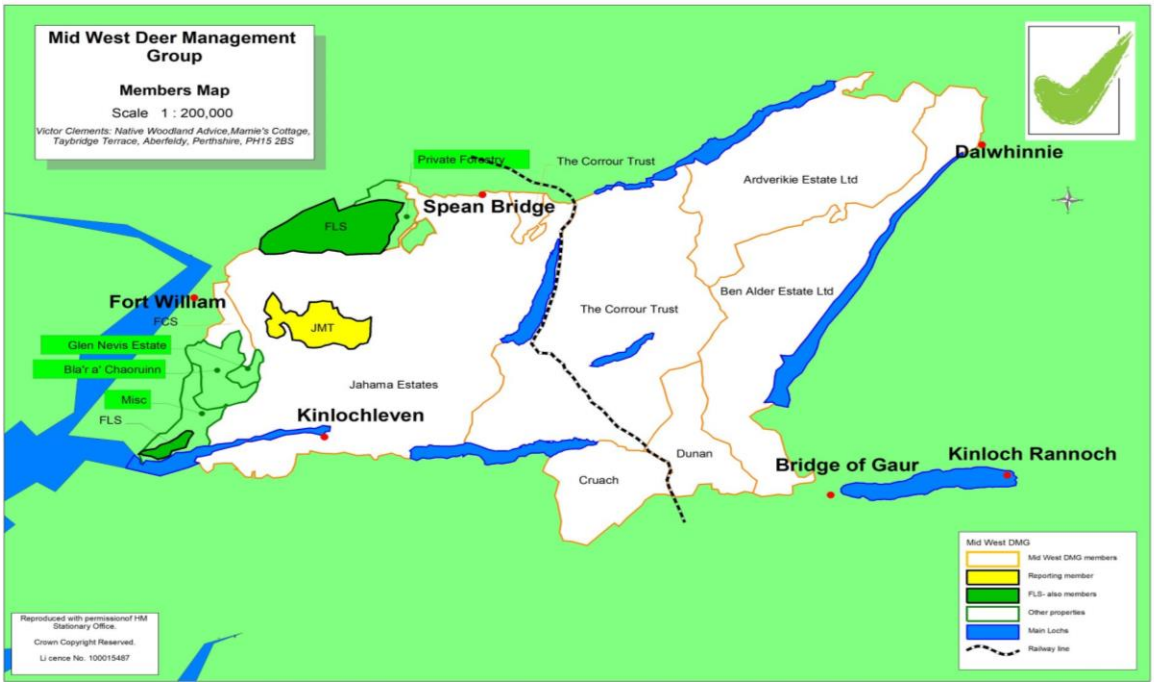

Plate 1 – Mid West Deer Management Group Area

The area to the east of Loch Treig (broadly to the right of the dotted black line/ railway line in Plate 1) is considered to be the eastern sub area, with the area to the west, largely occupied by Jahama Estates and Forestry & Land Scotland (FLS), being considered as the western sub area. For the purposes of planning, the two can be considered to be separate, although there will be some cross-over of deer populations.

The Corrour Trust and Ben Alder Estate Ltd are the two most important neighbours, both of whom share a long boundary with Ardverikie, so that their deer management is likely to affect Ardverikie as well, and vice versa. Dunan and Cruach are the other two members of the eastern sub area, but separated from Ardverikie, and much smaller in their extent.

It is important to note that all these properties share both environmental and deer production objectives, and while the degree of importance placed on each might vary, objectives are certainly converging rather than diverging. Extensive woodland creation, peatland restoration, protection of designated sites and hydro schemes can be found throughout, and all properties require at least some level of production from red deer. All properties employ full time professional staff, many of whom have been in position for many years, so the capacity for delivering effective management of deer is good, and there is an appreciation of range quality and management throughout. In addition, all properties either have full time professional management staff on site (Ardverikie, Corrour, Ben Alder), or have owners who are very active, engaged and able to quickly make strategic decisions as required.

Deer Numbers - CORRECTION

The Nature Scot helicopter count of the MWDMG area in 2021 has mistakenly shown the area counted on Ardverikie to be 16,590 ha, giving an overall deer density of 10 deer per sq. km, and 7.9 deer per sq. km for the eastern sub area as a whole.

However, it appears that this area of 16,590 ha includes an additional area of ground beyond the hill area, with the actual Ardverikie hill area within the MWDMG area given as either 13,215 ha (MWDMG Deer plan), or 13,977 ha (SLR Consulting Limited document).

For the purposes of this document, Ardverikie estate have clarified the hill area counted in 2021 as 12,990 ha, which includes any accessible woodland areas.

This updated figure would give an overall deer density at Ardverikie of 13.2 deer per sq. km, which is obviously a different starting point than 10 deer per sq. km might imply. This would give an average density for the sub area of 8.4 deer per sq. km, not 7.9 deer per sq. km as suggested in the MWDMG deer plan.

Beyond this, there are also variations in deer density at Ardverikie. The deer plan splits the larger areas up in to "reporting units", and for Ardverikie, this includes a western area next to the boundary with Corrour, and then the main body of the estate shown separately.

The following map, Plate 2, shows MWDMG deer densities on a reporting unit basis.

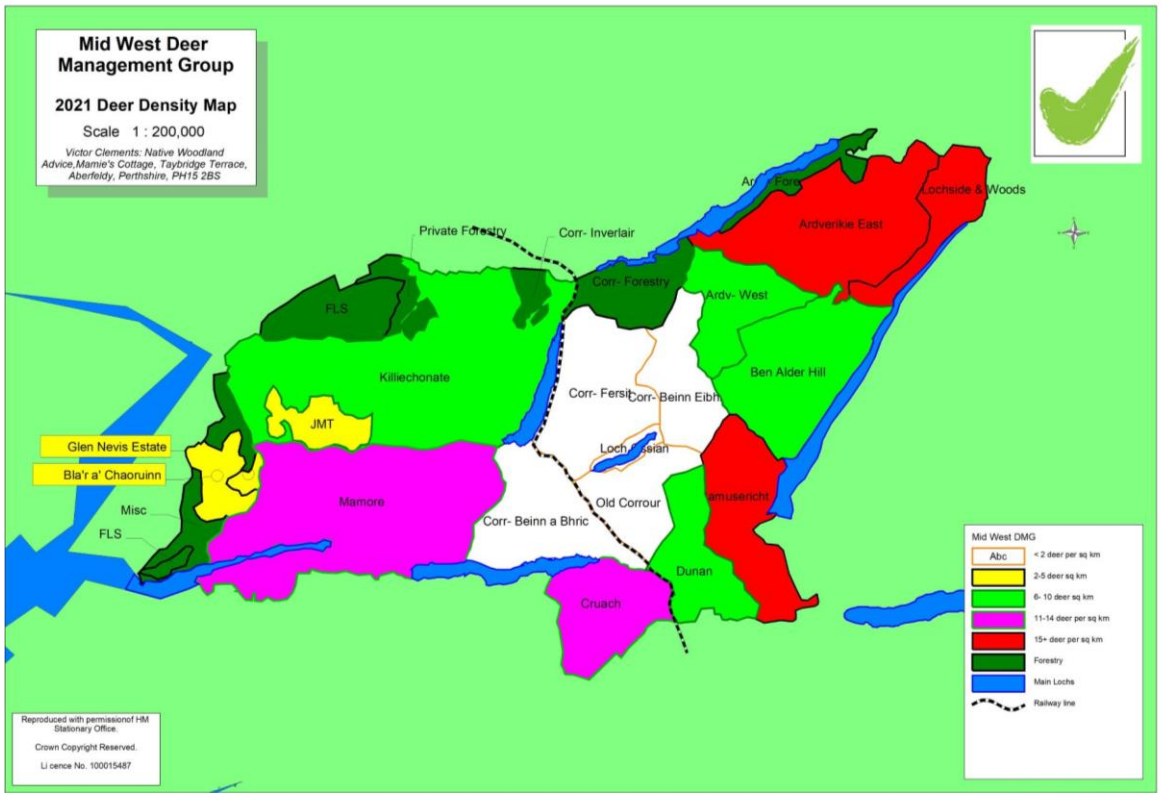

Plate 2 - MWDMG deer densities on a reporting unit basis

The map above shows two very different densities within Ardverikie, with 15+ deer per sq. km (actually 15.7) in the main body of the estate, and 6-10 deer per sq. km (actually 7) in the western unit beside Corrour.

The implication of this is discussed shortly, but first, it is important to understand the deer dynamics within the MWDMG area.

The Eastern Sub area

For c 15 years now, the deer dynamics within the MWDMG area have been dominated by Corrour Estate having a much more conservation focused approach than the other properties, with objectives to restore natural habitats, including native and montane woodland, and to try and achieve that without fences if possible.

Ongoing monitoring of woodland regeneration in particular suggested that very low deer densities indeed were required, and very intensive culling in 2020-21 left a deer density of less than 1 deer per sq. km by the time of the 2021 count, the white areas in the map above.

While the other properties shared conservation objectives, they did not subscribe to the approach taken by their neighbour to the west. To this end, Ardverikie and Ben Alder have both taken steps to concentrate deer at the eastern end of their properties, and both have areas of intermediate densities between them and Corrour. It is too early yet to see if this zoning can be sustained, or what a new equilibrium will look like. However, much of the proposed peatland restoration would now take place in one of the higher density areas, and this will change the dynamic again.

As noted in the MWDMG deer plan, there is good evidence to suggest that the TOTAL deer population within the eastern sub area is fairly self contained, and the strategy in the current deer plan is to try and maintain the 2021 total population, with culls allocated to achieve this. It is likely that the deer population present today will be similar to that present in 2021, across the eastern sub area as a whole.

However, the distribution will be different to that depicted above.

It is not possible to maintain very low and high densities on adjacent ground without deer drifting towards the former from the latter, and we know that deer from the higher density areas have drifted back on to Corrour. This is evidenced by culls on Corrour this past two years, which would not have been possible had the 2021 population remained steady on their ground. Corrour have been happy to accept some infill again, with very low densities being required on only one of their four beats (Fersit), and more toleration of reasonable numbers elsewhere, including reporting areas next to Ardverikie.

So now, going in to 2024, there will be more deer on Corrour than shown above, at least on three reporting units, and fewer on Ardverikie and Ben Alder, although it is not possible to say now what these numbers might be. A further count would be needed to establish this.

This is essential context to understanding deer within the eastern sub area, and how this might relate to the areas of peatland restoration in particular on Ardverikie.

MWDMG Deer Plan Objectives

Other than the conservation objectives at Corrour, which is undesignated, the major natural heritage interest on the eastern side of the MWDMG area is the Ben Alder & Aonach Beag SSSI/ SAC site, which includes a small area of Ardverikie, but which dominates the neighbouring ground on Ben Alder Estate.

You can see this area on the map below.

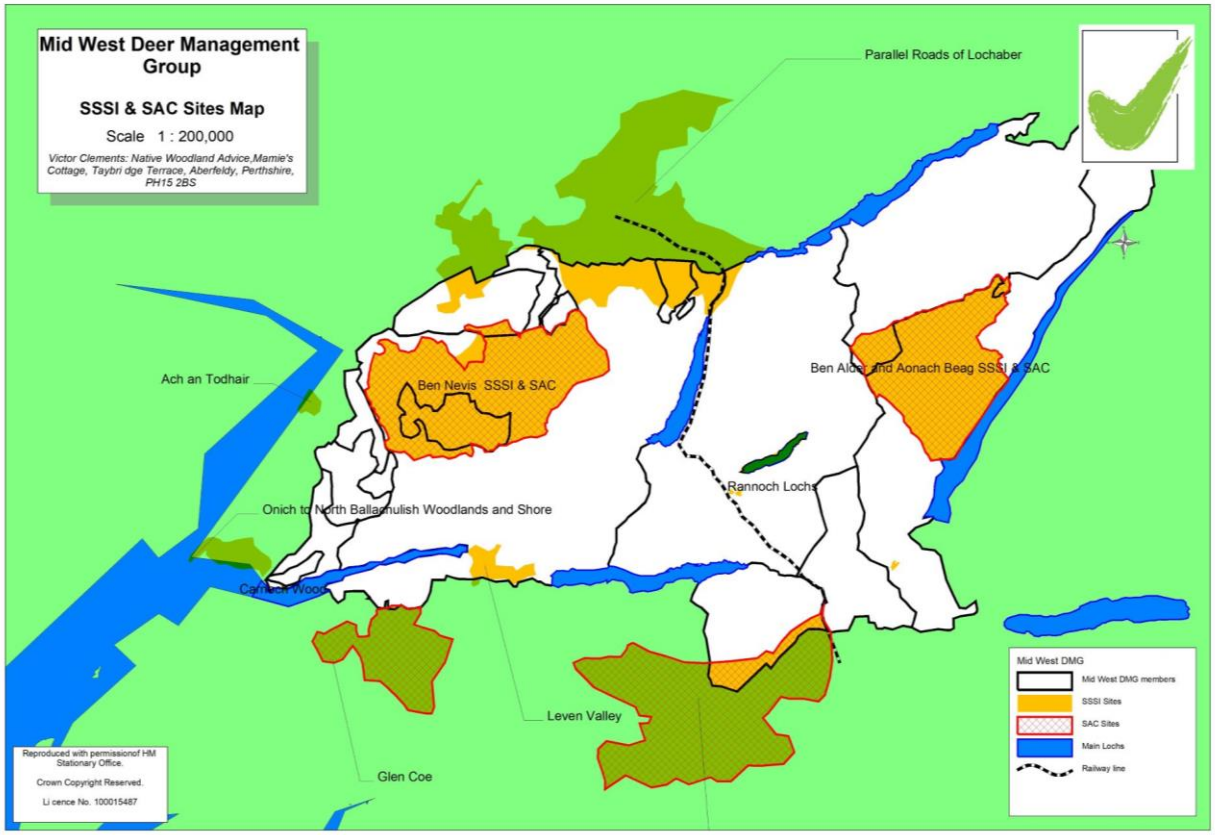

Plate 3 - MWDMG Designated Areas

This site has long been an area of priority for Nature Scot/ Scottish Natural Heritage, but an HIA report commissioned by Nature Scot in 2021 showed low impacts on almost all habitats across the area. This report, **Ben Alder 2021 HIA**, which focused primarily on peatland and blanket bog habitats, gave the DMG members confidence that the 2021 deer population was more or less correct for the eastern side of the group, and therefore, maintaining a steady population overall was the agreed deer management plan, with fewer deer on Corrour, and more on the eastern parts of Ardverikie and Ben Alder, and also on Camusericht, which is also owned by Ben Alder Estates Ltd.

As noted above, a drift from higher density areas towards Corrour was anticipated, so in effect, Corrour would continue to cull at least a proportion of deer counted elsewhere in 2021. The current deer plan and allocated culls is therefore designed to maintain low impacts on the designated site, maintain lower numbers on Corrour, but also allow for production on other parts of the DMG area.

The overall density was calculated at 7.9 per sq. km, although this now becomes 8.4 per sq. km when corrected for the Ardverikie area, as suggested above.

For clarification, the current MWDMG deer plan is to maintain the overall 2021 deer density of 8.4 deer per sq. km across the area, including the average 13.2 deer per sq. km on Ardverikie. This project will require the Ardverikie density to be reduced from 13.2 to 8 deer per sq. km across the whole estate within the MWDMG area, a reduction of 39 percent. The MWDMG density would reduce to 7.2 deer per sq. km overall, assuming that this project does not facilitate other reductions as well. The 39 percent reduction is a significant intervention on the estate, and will benefit a much wider suite of upland habitats and species.

This is the approximate deer density that you might expect to be compatible with good blanket bog condition. However, this figure is heavily skewed by the very low Corrour figures.

So, what would be an appropriate deer density for blanket bog restoration on Ardverikie estate?

Deer numbers and blanket bog condition

The corrected average deer density on Ardverikie at the count in 2021 is 13.2 deer per sq. km, with 15.7 deer per sq. km within the main area of restoration.

Within the SLR Consulting Limited document, **Outline Biodiversity Enhancement and Management Plan Overview (SLR Consulting Ltd, dated 24 November 2023)**, there is a very useful discussion about what an appropriate deer density might be under Section 5: Deer Management, on p 7. It cites a range of informed opinions, based on knowledge and experience in different parts of the country.

Current Nature Scot guidance suggests that 10 deer per sq. km is the appropriate upper level for maintaining a broad range of upland habitats, and densities above this are almost always flagged up as problematic for peatland restoration schemes.

Mention is made by others that densities above 8 per sq. km are likely to be damaging to peatland habitats, and peatland at higher altitudes is likely to be more sensitive than similar habitat at lower altitudes. A high proportion of potential restoration areas at Ardverikie are above 600 metres.

Nature Scot advise that densities of < 3-5 deer per sq. km are advisable on blanket bog sites. They make a distinction between blanket bog and peatland sites. In this case, the vast majority of sites being considered on Ardverikie will be blanket bog, which is essentially just peatland covering the landscape at scale.

The "< 3-5 deer per sq. km" figure quoted by Nature Scot is very different from the 8 or 10 deer per sq. km figures quoted elsewhere, and would require a fundamentally different deer management regime.

My own experience across 10-12 different deer management groups who undertake habitat monitoring is that appropriate densities depend very much upon the extent of blanket bog within a landscape.

Where blanket bog extends over a large proportion of a landscape, deer densities tend to be very low because blanket bog is a nutrient poor habitat, and it's carrying capacity is therefore low. In NW Sutherland for example, which has over 55,000 ha of blanket bog/ peatland dominating the landscape, 5 deer per sq. km is a useful working density for deer managers, and impacts have been shown to be low at that level.

Where the blanket bog extends over a smaller proportion of the landscape, it tends to be other vegetation types that set the carrying capacity, and deer tend to preferentially graze on these because of their higher nutrient status, and not the blanket bog areas. It is therefore possible to have relatively high deer densities but have little impact on blanket bog, but this depends to a large extent on the position of blanket bog in relation to these other habitats. Deer moving from A to B across an area of blanket bog can cause tracking. It tends to be movement that causes impacts, not grazing pressure as such.

At just 20 percent blanket bog/ peatland, Ardverikie would fall into this category.

The above would suggest that average densities of 13.2 deer per sq. km could be damaging to peatland / blanket bog sites at Ardverikie, or at least a proportion of them, depending on location in the landscape. Indeed, most of the peatland listed as Primary areas for restoration lie within the eastern part of the estate where average densities are 15.7 deer per sq. km.

However, there are two important pieces of evidence to set against this.

One is the 2021 monitoring on the Ben Alder & Aonach Beag SSSI/ SAC mentioned previously on adjacent ground, which shows almost universal low and low / moderate impacts on peatland habitats, despite having these higher densities within the general area.

The second is the routine blanket bog monitoring that has been carried out on Ardverikie since 2018, located across the estate, with a minimum of 32 plots monitored for both browsing and trampling each year, so this is a very good and consistent data set. The monitoring has been conducted by experienced estate staff using Best Practice methodology.

Almost all impacts in that period have been low.

For trampling, all impacts in 2023 and 2022 have been low. There was one high impact in 2021, 2 x moderate impacts and one high impact in 2020, one moderate impact in 2019, and one high impact in 2018.

For browsing, all impacts in 2023, 2022 & 2018 have been low. There were three moderate impacts in 2021, the same in 2020, and one moderate impact in 2019.

You can note the distribution of plots below from the 2023 data.

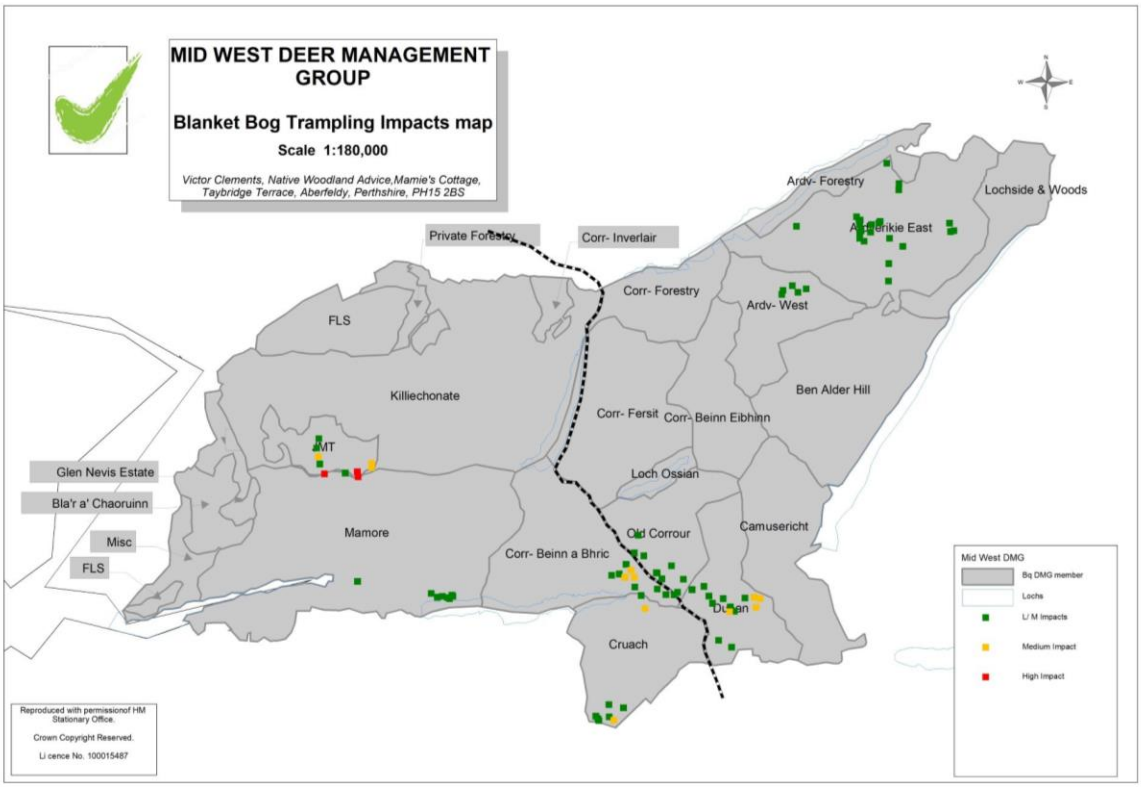

Plate 4 – MWDMG Blanket Bog Trampling Impacts Map

All of the blanket bog impacts on Ardverikie in 2023, browsing and trampling, were low.

In addition, it is noted from the ADL peatland report that most of the deer impacts noted across the areas for potential restoration were largely low or moderate. Anecdotal evidence from Tracks Ecology noted low impacts through most of the NVC survey area as well.

So, what is advised for Ardverikie, given that relatively high deer densities are apparently not currently causing significant impacts, either on the estate itself, or on the adjacent designated site, and surveyor reports in 2023 seem to indicate peatland vegetation in good condition overall?

Peat & deer dynamics

As suggested previously, peatland and blanket bog habitats, by their very nature, are nutrient poor. What this means in practice is that deer will favour grazing on other more nutrient rich vegetation if that is available to them. It is noted from the ADL report that peatland or blanket bog extends to 2964 hectares at Ardverikie, or c 20 percent of the estate. This means that c. 80 percent of the estate is comprised of better quality vegetation and deer are more likely to graze this, although a proportion of this will be montane vegetation which cannot sustain much grazing at all.

It is therefore possible and indeed fairly common to see fairly high deer densities but low browsing impacts on blanket bog/ peatland in Scotland, simply because the deer have better choices for feeding on other ground. Deer do not graze all parts of a

landscape equally. What is more problematic, and especially for restoration schemes, is the threat of trampling or tracking, which occurs when deer are moving from one area to another, and across an area of blanket bog. At higher deer densities, many peatland areas can avoid trampling impacts simply due to their location in relation to other habitats, but in some locations they will be very vulnerable.

The other thing to note is that during the winter period through to spring, deer will usually stay below the 600 metre contour, so it is very unlikely that higher altitude areas will be impacted at this time. If deer are getting fed, as a proportion of them are at both Ardverikie and Ben Alder, these deer will stay in the lower parts of glens, and not venture far. It is possible therefore to have fairly high deer densities in spring, with these deer only using a small proportion of the ground, and perhaps only impacting a small proportion of the peatland area.

In summer, deer will drift towards the higher tops, where significant numbers can accumulate. It is likely therefore that peatland at higher levels will be more impacted during the summer months.

The high densities of deer at Ardverikie are likely to spread out over a much wider area in the summer months, including possibly on to Corrour, but certainly on to the western part of the estate. So average densities in the summer months may well be less than the 13.2 deer per sq. km counted in spring 2021.

The evidence that we have suggests that current deer densities are broadly compatible with peatland habitats on Ardverikie, with evidence referenced above, even if those densities look high.

However, any "restoration" process will disturb the surface of the peat bog, and this will take some time to consolidate and bed in properly. Similarly, any areas of bare peat that are revegetated will be vulnerable for a number of years, until the new growth is relatively strong. Such areas are likely to be more attractive to deer than areas with more rank vegetation.

The restoration process itself is therefore leading inevitably to a situation where habitats are less robust in the short term against herbivore impacts than they were beforehand, at least for a number of years until changes have bedded in.

The ADL document gives a useful breakdown of potential restoration areas in to Primary, Secondary and Tertiary, with 571 ha, 392 ha and 68 ha of each respectively. The "primary" areas are those with the best chance of a successful outcome, and which are "resilient to the restoration process". The "secondary" areas are more difficult to fully restore successfully, and will be more vulnerable to herbivore impacts, but there may be other factors at work as well, including the nature of the peat, the level of current vegetation, the hydrology of the area or the presence of slopes. The "tertiary" areas will be most challenging to restore, but there are only 68 ha of this classified at present.

You can see these areas marked out in **Appendix 6** to this document.

The areas of primary restoration are concentrated in three main areas, rather than scattered across the whole estate, and this should in theory at least make it more manageable to concentrate deer management interventions in those areas if necessary.

We can assume that the areas for primary restoration, which are most likely to succeed, can withstand a higher deer density than the areas of secondary restoration, which in turn can withstand more than the areas labelled as tertiary.

What deer density is advised at Ardverikie?

A suitable deer management plan needs to define an appropriate target density, to be achieved by a certain date, typically three or five years.

For a high profile project such as this, with restoration work taking place over a very extensive area, it is important to have the deer densities right from the outset. For context, 813 ha of peatland restoration would be one of the largest such schemes in Scotland, with a lot of money and reputation invested.

In terms of strategy with deer reductions, it would be better to go further than you think you might need to at the start, and then relax a bit if you think you can, rather than not get a suitable density at the outset, risk damage, and then try to catch up over a longer period with the restoration always vulnerable.

In this case, we accept that the restoration process itself will lead to higher impacts, so the deer density at present needs to reduce. We know that NatureScot will not accept densities above 10 deer per sq. km, and the hill area at Ardverikie was on 13.2 deer per sq. km in 2021, and 15.7 deer per sq. km in the areas where most restoration is likely to occur. There also needs to be a suitable buffer to give people confidence that the restoration will be successful, and a significant proportion of this restoration will be at higher altitudes, and hence more vulnerable.

The SLR Consulting document already referred to suggests reducing deer densities to 8 per sq. km, a 20 percent reduction from 10 per sq. km, although we now know this latter figure to be incorrect, and the density within the areas of restoration is actually 15.7 deer per sq. km. This would be a deer reduction of 49 percent, across the greater area of the estate (39 percent across the estate as a whole), although a maintenance cull would suffice across the western part of the property, especially as very little restoration is envisaged there.

The choice at the outset is subjective, but my instinct would be that reducing the deer density to 8 deer per sq. km would allow the primary areas of restoration to succeed, hopefully with a buffer built in.

Some modelling analysis on this will follow. A four year reduction period will be proposed to get to 8 deer per sq. km, getting to 10 per sq. km in two years first. The reason for not going faster is that intensive culling operations create more movement within a deer population, and this in itself can create trampling damage. A longer reduction period requires more deer to be removed overall, but it allows for a more gradual approach, avoids big operations that deer will inevitably react to and cause them to gather in larger herds, and allows stalkers time to adjust the age structure in a way that retains as many higher value animals as possible. Where trampling damage is to be avoided, it is especially important not to force deer in to large, unmanageable herds as this cannot easily be undone. New behaviour will have been learned and passed from one generation to the next.

A four year reduction could be begun in 2024-25, well in advance of any restoration. However, for the purposes of this document Year 0 will be used to denote the first year of any operational deer reduction plan, in case the scheme is delayed.

The areas of secondary and tertiary restoration are obviously proportionately more susceptible to deer pressure, and the greater the area of this included, the lower the deer density will need to be. In this case, there is no knowing if 8 deer per sq. km will still suffice, but we can say that the more of these areas that are included, the greater the risk of a poor result becomes.

This leads to the question of whether the areas of secondary and tertiary restoration should be attempted at all? It should be noted however that there is not always a clear distinction between primary/ secondary/ tertiary areas, and individual site inspection and risk assessment is required at the outset. The principle of hydrological units is accepted, in which all restoration within an individual catchment should be attempted if it is practical to do so. In this way, some secondary peatland areas may be deemed to have higher priority than primary areas elsewhere.

The object of this mitigation/ enhancement is not to restore all the peatland on Ardverikie, it is to restore enough to mitigate against the losses due to construction and inundation, and to provide for biodiversity net gain overall.

The question is whether the majority of the areas of secondary and tertiary restoration, could be replaced by restoration of a different kind, with the obvious option being to do more on the woodland front. This is likely to be easier to control, with greater certainty about the overall outcome and it would also diversify the outputs of the restoration. Woodland would be much more visible in the landscape, and perhaps more tangible to some people.

The option might then be to restore as much of the 571 ha of primary peatland as possible, incorporate other areas with same catchments up to 625 ha[1] and introduce a much more ambitious woodland restoration programme with the funding it would otherwise have taken to restore the presumably more expensive and riskier secondary and tertiary areas.

This would still be recognizable as a variation of the plan put forward by SLR Consulting, and would still be making use of the development work undertaken to date.

It would provide for greater certainty that 8 deer per sq. km would deliver a good outcome in terms of peatland restoration. Including significant areas of peatland that are more difficult to restore will inevitably require a lower population, and this will then certainly be conflicting with other estate objectives.

This option is set out below under **A Larger Woodland Option**.

However, at this point, it is worth setting out very briefly as context why retaining a deer population is important at Ardverikie.

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[1] *The balance to be made up of secondary peatland restoration within targeted hydrological units, including those close to the Shuas dam and in Coire Pitridh.*
These areas can be noted in Appendix 6.

Retaining a viable deer population

There are two reasons why a deer herd should be retained at Ardverikie, albeit at a lower level than at present.

Firstly, this would respect the cultural heritage and traditions of the estate, which is important to the owners and staff.

Secondly, it should not be assumed that lower and lower deer numbers means more and more public or biodiversity benefit will accrue. There are a wide range of habitats at Ardverikie, and while some of those are vulnerable to herbivores, there are others like the 646 ha of grassland that require grazing to preserve species diversity in the sward. The upwards of 9000 ha of heathland will also benefit from having a range of grazing impacts, creating a variety of vegetation structures that can be used by a greater variety of wildlife. Deer are the only means of achieving this when thinking about vegetation management on this scale.

As suggested above, the objective of this deer management plan is to facilitate clear and unambiguous net biodiversity gain, and not necessarily to "restore" every hectare available, particularly if this might risk regression in others.

The development work being undertaken by a range of consultants is defining what that biodiversity gain might be.

Leaving a viable deer herd is part of the overall balance being sought by all parties. Ardverikie Estate have made clear that while they are prepared to implement a very significant reduction cull to facilitate important peatland restoration and woodland development, they do not want to see deer reduced to very low numbers.

A larger Woodland Option

The plan put forward by SLR Consulting envisages c. 68 ha of new woodland creation around the enlarged Loch Earba to compensate for the c. 7 ha of woodland that will be lost. Part of this 7 ha is noted as ancient woodland. This is part of **Option A** listed later in this document.

I would argue that although the compensation planting is very significant in relation to the area lost, that such an approach is very narrow in it's focus, and lacking in any real analysis of the wider native woodland resource within that area of the estate, and the potential that might exist for more meaningful restoration.

From a biodiversity/ conservation perspective, the most valuable woods on Ardverikie Estate are those growing alongside Loch Laggan. You can see these woods in **Appendix 1** in this document. Although they are comprised mostly of non-native conifers, these woods are classified as PAWS (Plantations on Ancient Woodland Sites). In effect, they are ancient woodland sites that have conifers growing on them, but it is possible to restore such woodland back to something approaching their former state by gradual management over several decades, gradually and slowly removing the conifers, and encouraging native species.

If these woods have the highest woodland biodiversity value in the surrounding landscape, then any new woodland creation will have most biodiversity / conservation impact if it is planted next to this area. The 68 ha of planting around the enlarged Loch Earba will struggle to function properly as riparian habitat as the water level will be rising and falling on a very regular basis, with an unvegetated

transition zone around the loch. These woods would have a higher impact if planted as an extension to the ancient woodland area, although implemented as suggested, they will still have a landscaping/ screening function, and contribute to overall habitat connectivity.

However, in this new location, you can then start to think about how big such an area might be.

It is very difficult to look past the fact that the two dams associated with Loch Earba will be called the Shuas Dam, and the Shios Dam, named after the two hills that lie between Loch Earba and Loch Laggan. Binnein Shuas extends to 747 metres, and Binnein Shios to 667 metres.

Would part of the most appropriate environmental mitigation for this scheme not be to restore the two mountains after which the dams in the scheme are named, particularly when they overlook the project itself? On the other side of the loch, there is a slightly smaller hill called Creag a Chuir at 643 metres. It has a significant woodland area around its lower slopes, and this should respond well to grazing being removed.

Proposal
The proposal here (referred to later as **Restoration Option B**) is that these 3 hills and the loch are fenced off from the main deer range at Ardverikie, an area of approximately 1000 ha in total, excluding water, to deliver four main outputs:

1. There is likely to be a significant level of native woodland regeneration within the area, notably on the lower and middle slopes of Binnein Shios and also Creag a Chuir. This could well extend to over one hundred hectares.
2. It should be possible to establish an additional 2-300 ha of native woodland planting within the area, possibly more, and to include the 68 ha envisaged in the SLR Consulting proposal around the loch
3. The 3 mountains provide the opportunity to create montane woodland on a significant scale. In effect, montane woodland could be linked by native woodland planting and regeneration down into the ancient woods alongside Loch Laggan, providing woodland habitat from loch side to mountain top. You can argue that the mountains are not very big, but they are big enough to create the desired effect, and to inspire people who come to see them.
4. Within this area, there will be a proportion of open ground habitats that will benefit from having grazing removed as well, including, probably, a modest amount of peatland.

An indication of the type of woodland envisaged is given in **Appendix 1** to this document.

Obviously, such a scheme would take time and expense to develop properly, but there are a number of key advantages:

1. A combination of a scheme on this size and 600 ha of peatland restoration leaves no doubt or ambiguity that significant biodiversity net gain has been achieved, and restoration of Binnein Shuas and Binnein Shios firmly links biodiversity gain with the hydro scheme itself, alongside the wider deer management on the estate, and the other measures detailed in the original

OBEMP overview document, which would remain largely unchanged. This is a very significant project in a Scottish context.

2 Although a significant variation of the proposal being developed by SLR Consulting Limited, what is being proposed here is hopefully recognizable as a version of that, and makes full use of development work to date.

3 The location is easily accessed from both the Cairngorms and from Lochaber, so has the potential to become a key mountain woodland demonstration project within Scotland as a whole. Obviously, there are significant benefits to both the developer and the landowner from this.

4 Removing the areas of riskier peatland regeneration will give greater certainty of outcome, and make deer management easier to deliver, while still leaving a deer resource for Ardverikie Estate.

5 The saving from not undertaking some of the peatland restoration suggested can be transferred to this woodland scheme.

6 Enclosing the mountains gives much greater certainty of outcome for proposals there, and are much more practical than trying to deliver montane willow woodland through deer control on the estate more generally. Experience at nearby Corrour suggests that deer densities of 1 per sq. km or less are required, and Ardverikie estate are not prepared to do this.

Deer Management Implications

The key rationale for putting forward such a proposal is that it greatly simplifies the deer management analysis required, and provides for much greater certainty of outcome, which is important to all involved.

The proposal would involve removing deer from over 1000 ha of land around Loch Earba, and reducing to and then maintaining a population of 8 deer per sq. km across the remainder of the property.

As stated previously, the objective required is to mitigate unavoidable habitat loss and provide for clear biodiversity net gain, not to "restore" the whole of Ardverikie Estate. The proposal would create very significant benefits for peatland sites and woodland within the area, as well as a range of other open ground sites, and do this on a very significant scale, and with a high certainty of success.

POPULATION MODELLING

Population models are the working part of any deer management plan. They set the target density to be achieved in a given time period, but are otherwise flexible to varying recruitment or mortality rates, with deer numbers to be culled adjusting as required.

Metrics

There are a number of important metrics that are necessary for a population model to work effectively:

1 There should be an accurate baseline population to work from. In this case, the helicopter count in 2021 was only three years ago, so that information can be used as a starting point.

2 Recruitment into a population is best quantified by a "recruitment count", best undertaken in late April/ early May, with a sample number of hinds counted along with their surviving calves from the previous year. Good data has been

gathered for the MWDMG area for the past two seasons, including over 200 hinds on Ardverikie each year. The level of recruitment is perhaps the most important data within a population model.

3 Default mortality is given as 2 percent for stags and hinds, and 6 percent for calves. Where there is evidence of unusual or higher than normal mortality, animals will be counted and added in above the default levels.

4 All culls are collated on a "reporting unit" basis, with the deer year being from 1st April to 31st March.

For the MWDMG area, the boundaries are very secure to deer movements, being defined by lochs, so the population is largely self contained. However, there is significant movement within the area, and distribution across reporting units is difficult to gauge.

Models

There are 10 population models attached to this document which look to tease out important aspects of deer population planning on Ardverikie, and inform the necessary culls covering a range of situations. The following notes provide a summary of the essential detail in each, so it is not necessary to open each spreadsheet. The models can be located at **Loch Earba PSH Deer Population Models**, on ten different tabs.

The current agreed population model for the eastern sub area of MWDMG is shown as **MODEL 1: MWDMG East Side Model 2023-28**. This includes actual culls from the helicopter count in 2021, and an updated agreed target for 2023-24. The target density is adjusted to 8.4 deer per sq. km. This model can be adjusted once final plans are agreed for Ardverikie. Modelling at this level is important in that culls can be allocated between properties, but adjusted if necessary if deer are located in one place and not another. It is important that Ardverikie are aware of what is going on beyond their boundaries, and vice versa, and that properties co-operate to deliver agreed overall culls.

The **MODEL 2: Ardverikie Model from 2021** shows actual culls from then, and projects forwards with 2023-24 targets repeated to spring 2028. This model suggests that Ardverikie culls are not sufficient to contain the 2021 population. However, we do know that culls elsewhere would not be possible without some drift of deer from higher density areas, and it is highly likely that there is emigration of deer from Ardverikie.

Ardverikie staff try hard to maintain a stable population. If we assume that the population is indeed stable, then we can quantify what emigration is likely to be. The **MODEL 3: Ardverikie Model from 2021 with estimated emigration** sheet suggests that average emigration of 30 stags, 27 hinds and 9 calves would be necessary to give a stable population, and this seems entirely possible given the very low deer density on adjacent property.

At this point, we highlight a major uncertainty going forwards. Ardverikie and Ben Alder have very similar deer densities, and while there will be movement back and forth, there is unlikely to be too much net movement one way or the other. However, there is almost certainly a level of emigration towards Corrour.

As the Ardverikie deer density reduces, there is likely to be less emigration towards Corrour (reduced push factor), but potentially more immigration from Ben Alder. It is not possible to quantify these variables in advance, so there will need to be a check point at perhaps two years' time, so that adjustments can be made if necessary. A helicopter count will be suggested for Year 0+2, five years on from the count in 2021, and progress checked at that point. This may need to be a privately funded count, albeit overseen by Nature Scot.

For the purposes of this document, it is assumed that any deer reduction cull will start in year 2024-25, but recognizing that any timeline could be delayed. From this point in the document, 2024-25 will be denoted as Year 0, 2025-26 as Year 0+1 and so on.

Restoration Option A is that suggested by SLR Consulting Ltd in the OBEMP overview document, which is to reduce deer densities to 8 per sq. km to deliver 813 ha of peatland restoration and 68 ha of fenced native woodland planting. It is suggested that this reduction takes place over four years. The **MODEL 4: Ardverikie Model- Reduce to 10 per sq. km by Year 0+1, then 8 per sq. km by Year 0+3** sheet shows what this would entail. A reduction cull would start in Year 0, with two years of high hind culls, before falling back to Year 0-1 levels. This is a significant increase, but manageable.

The model assumes that the same emigration level will continue throughout, but this might not be the case. It may also be the case that immigration from Ben Alder becomes apparent. A helicopter count is therefore advocated in spring Year 0+1, half way through this reduction, and culls then adjusted if necessary.

It is possible that 8 deer per sq. km will still result in damage to restored peatland areas, particularly if the full extent of restoration is attempted, as mentioned previously. It may then be necessary to reduce the density to 6 deer per sq. km, or less likely, to 4 deer per sq. km. In practice, a reduction of 1 deer per sq. km is unlikely to create much of a difference in impacts, so reductions of 2 deer per sq. km are evaluated throughout.

In the event that further reductions are required, the likely culls are set out in the **MODEL 5: Ardverikie Model- Reduce to 6 per sq. km by Year 0+5, then 4 deer per sq. km by Year 0 +7** sheet. These culls are slightly above Year 0-1 levels for two years, then broadly comparable. It is assumed that as the population decreases, the recruitment will increase, but it is not known where this might kick in. For the purposes of this planning exercise, the recruitment rates used in this sheet have been increased from 32 to 35 percent, but they could increase to 40 percent, or perhaps a little more. Actual rates can be checked on an annual basis, and cull targets adjusted for the following season, so variation can be accommodated.

At these lower densities, it is thought unlikely that emigration might still occur at previous levels, and indeed, immigration is then likely to be evident. In the above sheet, emigration is reduced to 15 stags only, but in both this model and the previous one, better estimations of immigration/ emigration are required, aided hopefully by a Year 0+1 helicopter count. It is possible that culls required will be greater than suggested here.

The next four models show what a sustainable cull would be at a range of deer densities on Ardverikie. All assume no net emigration/ immigration, but this exercise does give a feel for what level of activity would be possible at different densities.

The models are:
MODEL 6: Sustainable cull- 10 deer per sq. km
MODEL 7: Sustainable cull- 8 deer per sq. km
MODEL 8: Sustainable cull- 6 deer per sq. km
MODEL 9: Sustainable cull- 4 deer per sq. km

As the density reduces, the recruitment rate goes up from 32 percent, to 35 percent, to 38 percent, to 40 percent.

The effect on what a sustainable deer cull might be at each of these densities is set out in the table below. As stated, these do not include net emigration/ immigration, which is not possible to quantify at the moment, and which is likely to be significant, with immigration being more important than emigration as density reduces.

Deer Density	Recruitment rate	Stag cull	Hind Cull	Calf cull
10 per sq km	32%	70	75	25
8 per sq km	35%	60	75	25
6 per sq km	38%	50	53	20
4 per sq km	40%	37	37	15

At 10 deer per sq. km, sustainable culls are broadly the same as current culls, but there will be an element of emigration that is not included.

A reduction to 8 deer per sq. km does not appear to make much difference, beyond a reduction of 10 in the stag cull to 60 animals. Emigration is likely however to feature as well, although some immigration is likely to be occurring too. These variables need to be checked by an interim helicopter count. Note the increase in recruitment almost negates the overall lower population, emphasizing the importance of knowing this figure via annual checks.

Subsequent deer reductions to lower levels means that fewer stags can be expected, but this is getting further and further from the known deer dynamics that exist at present. The emigration/ immigration balance needs to be determined.

For options A and B, a reduction of deer density from 13.2 per sq. km to 8 per sq. km on Ardverikie is a reduction of 39 percent. The reduction at a MWDMG eastern sub area is much less pronounced (from 8.4 to 7.2 deer per sq. km), or 14 percent, Ardverikie occupying a relatively small proportion of the total area.

Restoration Option B, the **MODEL 10: Ardverikie Woodland Option** model, looks at the effect of reducing the population to 8 per sq. km, but reducing the area of the hill by c 1150 ha to accommodate a woodland restoration scheme. The

emigration estimates are included to make this comparable with the proposal to reduce deer density to 8 per sq. km across the whole estate.

Interestingly, the difference in deer numbers between Options A and B equates to just 86 animals in total in the population, with the woodland Option B being slightly less, so the difference in terms of deer management is very small in terms of numbers. The benefit would come from the greater certainty of outcome, both in terms of peatland restoration, but also the much reduced risk of deer having to be culled to a much lower density.

There is a final **Restoration Option C**, which is to do all restoration work on the Aberarder part of Ardverikie Estate, to the north of the road, and not do any of the peatland work or woodland work envisaged on the main part of the estate. The advantage to the estate of doing this would be that as this is next to the Creag Meagaidh National Nature Reserve, deer numbers there are already very low, in theory at least, so further reductions could be achieved relatively easily without significant changes to estate management. At the moment, we are not sighted on either deer density information or on habitat type, but it might be expected that in such an area, habitat restoration would focus very heavily on native woodland expansion, with a lesser level of open ground habitats. The area involved is approximately 3000 ha, with 1600 ha potentially available and having no other obligations, and with the location noted in Appendix 5 of this document. The benefit would be a very significant native woodland area adjoining the National Nature Reserve, which will inevitably strengthen and protect the integrity of the woodland there in the landscape for the longer term. The disadvantage would be that there is no obvious physical link with the Loch Earba project, but perhaps this is of lesser importance, and there is a lack of potential for obvious peatland restoration as well. Some of this area would be outwith the current agreed development area.

A brief site visit suggested that there are two possible ways of doing something significant at Aberarder.

Restoration Option C1 would involve the implementation of a similar deer management regime to the neighbouring Creag Meagaidh NNR. This could be implemented relatively easily, with little in the way of consequences for Ardverikie Estate. However, the distribution of seed source is such that outputs are likely to be relatively modest, certainly within a ten year window from the outset. Woodland extension is likely to be tens of hectares in that period, and very unlikely to be more than low hundreds of hectares. One risk might be that the forestry to the east and north of Aberarder will contain a population of sika deer as well as red and roe, and therefore achieving an appropriate level of deer management will be proportionately more difficult, perhaps more than might be immediately apparent.

Restoration Option C2 would involve a very large fenced woodland creation scheme, perhaps up to montane level on the boundary with Creag Meagaidh. This would certainly be possible, as a high proportion of the area would be plantable ground, with a significant proportion above the 600 metre contour as well. In addition, some of the lower ground is fertile and well drained, so options arise for planting an oak dominated woodland, grading in to birch and pine, and then up to montane. The risk in such a scheme would be that fencing at higher altitude would be difficult to maintain, and it is known that fencing near the boundary with Creag Meagaidh has been vulnerable to landslides in the past. The advantage is that a very large area of new woodland would be possible in a short timescale, and this would

significantly improve native woodland habitat networks in the area, benefitting Creag Meagaidh and others to the east as well, linking through in to the Cairngorms National Park.

Recommendations

1. There is a big strategic decision to be made here as to whether a restoration programme could be undertaken entirely on the Aberarder part of Ardverikie Estate, **Restoration Option C**. That would be the easiest project to deliver, is likely to be the cheapest, and would be by far the quickest to deliver in terms of deer management. However, it would be fundamentally different to what is envisaged at the moment, would focus mainly on woodland habitats not open ground habitats, and it could delay a planning application which is not an option for the developers at present. Much would also depend on the views of adjacent landowners, including NatureScot.
2. **Restoration Options A & B** are essentially variations of one another. Option B gives greater certainty of a successful outcome, and focuses on woodland and peatland outputs, instead of primarily peatland, as well as allowing for more compensation / net gain for montane willow / heathland.
   By way of clarification, **Option B** is the preferred scheme for both the Applicant and Ardverikie Estate, and is supported by all their professional advisors. Option A is viewed as being too risky in terms of outcomes, and Option C, although easier, does not give a good range of outcomes.
3. Deer movement within the MWDMG eastern sub area is significant, with the balance of emigration/ immigration between properties being impossible to predict. However, assuming Option A or B is being implemented, if 8 deer per sq. km is the target density, then two years of significant reduction culling could begin in Year 0 to start the process and achieve the greater part of the reduction required, before a helicopter count check is undertaken in spring Year 0+1. That should then allow the reduction cull to be completed with greater certainty to reach 8 deer per sq. km by spring Year 0+3.
4. The 32 blanket bog monitoring sites used by Ardverikie Estate should be re-allocated to within the restoration areas, or a greater number if this is deemed to be more appropriate. It is likely that information provided by independent contractors would be more robust and trusted by external parties.
5. For the scale of peatland restoration envisaged, and beyond any helicopter count, it is likely that drone counting, perhaps on an annual basis, would be a cost effective means of keeping track of numbers in sensitive areas.
6. If a very large woodland enclosure was to be created as suggested, and given the presence of roe deer, sika deer and wild boar, then ongoing provision needs to be in place to ensure that animals do not become established within that area, especially given the more sensitive nature of the montane woodland habitat envisaged.
7. Finally, the MWDMG deer plan can be adjusted very quickly to reflect which ever option is chosen, and the DMG can see that this is then implemented in conjunction with managers on neighbouring ground.
8. It is very important that neighbouring properties are sighted on deer planning aspects of this project before it goes to planning, and that they have the opportunity to contribute to any plan in a meaningful consultation beforehand. For this reason, once the OBEMP is defined, a wider set of discussions need to be undertaken. This need not take very long, but it is essential that there are no surprises.

Comparisons & Context

The largest single native woodland scheme currently in Scotland is probably now the pinewoods at NTS Mar Lodge on Deeside, extending to well over 1500 ha, and expanding rapidly at present. The Wildland property at Glenfeshie is of comparable size, but also has several thousand hectares of pinewood planting adjacent. In collaboration with their neighbours (NatureScot, Forestry & Land Scotland (FLS) and RSPB), their joint Cairngorms Connect project will be the largest in Scotland.

On Loch Katrine in the Trossachs, Forestry & Land Scotland (FLS) have planted 1500 ha of native woodlands, and this is now set to be extended by natural regeneration. In conjunction with their neighbours (Woodland Trust Scotland, RSPB and private landholdings, and supported by BP), the Great Trossachs Forest is approaching the size of Cairngorms Connect. The pinewood regeneration efforts in Glen Affric and adjacent glens being taken forward by Trees for Life, FLS and others are also of this scale.

Other significant projects within Scotland might include Carrifran Wildwood in the Scottish Borders, the adjacent (to Ardverikie) Creag Meagaidh NNR site managed by Nature Scot, and the very large Kinlochleven scheme, also within the MWDMG area.

On peatland restoration, the neighbouring Corrour Estate has a 750 ha peatland scheme, there is a concentration of large schemes in the Monadhliaths, and Glasgow City Council have just announced a very significant scheme on moorland within their council area.

By way of comparison, the biodiversity planning at Ardverikie involves smaller woodland and peatland schemes, but the scale of both is still very significant at a national level, but it should come to stand comparison with these other initiatives. The combination of activities at scale is notable and, properly implemented, should certainly give Ardverikie and the developer recognition at a national level, and be an asset to all concerned.

The woodland proposals at Ardverikie would restore native woodland from loch side to mountain top, and while those mountains might not be very big, they are easily accessible, and will demonstrate to others what is possible. The proposals should also see Scots pine regeneration rising to a significant altitude.

In terms of renewable energy, the 1800MW capacity of this scheme outstrips all other pumped storage hydro schemes either in operation or development, in addition to its capacity to moderate power flows from other parts of the country for significant overall benefit.

There is no question then that in terms of helping mitigate the twin biodiversity and climate change challenges that we face, that this site at Ardverikie with its woodland and peatland restoration and renewable power will be hugely significant indeed.

In terms of collaborative deer management, the east side of the MWDMG will have to deliver this scheme, conservation objectives at Corrour, including significant peatland restoration, and maintain the Ben Alder and Aonach Beag SSSI/ SAC, as well as woodland and peatland schemes on both Dunan and Cruach. There is obviously strong conservation management on Ben Nevis and the Mamores as well as the adjacent Creag Meagaidh NNR, so there will now be a concentration of very

significant projects in this area, in addition to the concentration of hydroelectric schemes, with Loch Earba simply then being the largest of the many schemes utilising the many lochs in the locality.

This commentary is provided to underline the scale of what is being proposed, and to try and put that in some context at a national level.

Victor Clements
Native Woodland Advice
6th February 2024

APPENDICIES

There are a series of six appendices set out in this document, showing a number aspects of what is proposed.

The appendices are:

Appendix 1 Woodland restoration proposals

Appendix 2 Binnein Shuas

Appendix 3 Binnein Shios

Appendix 4 Creag a Chuir

Appendix 5 Aberarder

Appendix 6 Peatland Proposals

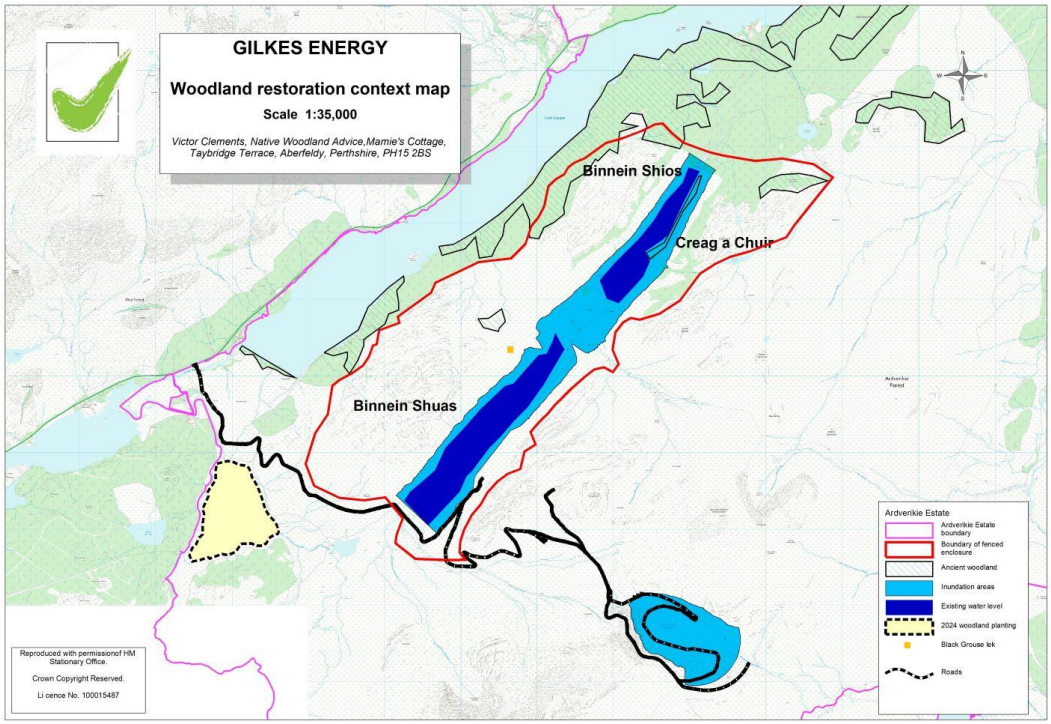
Appendix 1 Woodland restoration proposals

The woodland proposals put forward here are those being included as **Restoration Option B**, in addition to approx. 600 ha of peatland restoration.

The intention is to create a very large deer fenced enclosure taking in the loch and the three hills of Binnein Shuas, Binnein Shios and Creag A Chuir. The total area would extend to 1496 ha, of which 354 ha would be inundated by the Earba reservoir.

1111 ha of dry land habitats would be enclosed when areas of infra structure are excluded.

The proposed enclosure is noted on the map below:



There are a number of advantages to enclosing the whole area as one, and not in two separate blocks:

1 People accessing the area, either to walk the Binneins, or proceed through to Ardverikie, are most likely to walk on the Binneins side of the loch. Having entered the enclosure, they will be free of the sight of fences for the rest of their journey through the area. This might be especially appropriate for those going to climb on the Ardverikie Wall.
2 Putting the fence on the other side of the loch removes the need to mark fences for black grouse, there being a lek between the two Binneins.

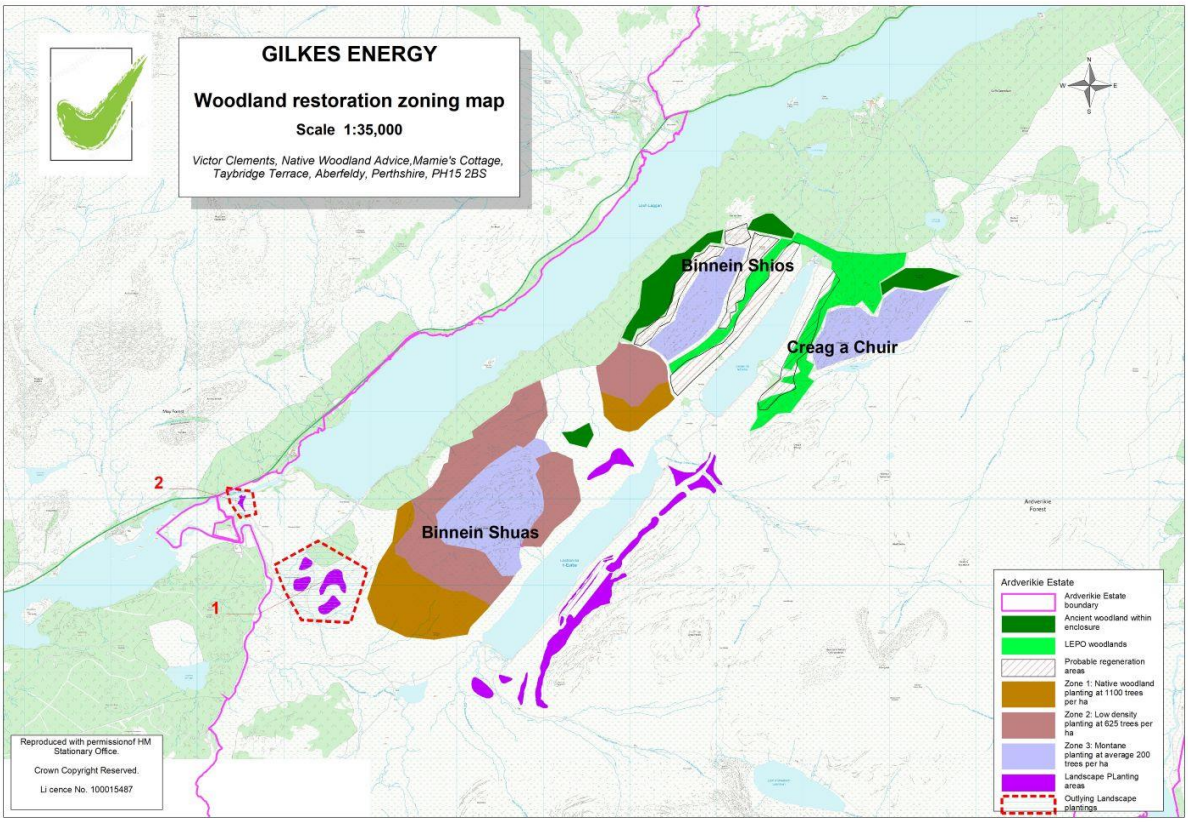
3 Fencing around the loch allows flexibility for planting the full 68 ha of riparian woods suggested by SLR Consulting Ltd, and this could have a useful landscaping/ screening effect.
4 Less fencing would be required overall, and avoiding the need to mark for grouse would mean that less material overall was required.

The fence would be located 100 metres back from the main access track to the dam, and this should mean that site staff and visitors will not be dominated by the presence of the fence as they travel to Loch Earba.

Also marked on the map above is an area of native woodland planting due to be implemented in 2024, and extending to 87 ha. Although the new planting will not directly adjoin to this, the gap is only 700 metres, so there will be continuity of woodland in the landscape, linking through to Corrour and beyond. The gap is important to allow deer access through the landscape, although it is anticipated that deer density will be low in this area going forwards.

Woodland Prescriptions

The map below shows the type of woodland that is envisaged.



The areas of dark green are ancient woodland, extending to 65 ha, or 6 percent of the total enclosure area. Almost all of this woodland is birch dominated. It is not clear at this stage what minor tree species might be present. Enclosure of this area will allow for proper establishment of ancient woodland ground flora, and possibly a

shrub layer as well if a seed source is present. There is likely to be regeneration within the 65 ha area, and the ancient woodland area will also act as a seed source for areas of regeneration outwith the area defined.

The light green areas are areas of LEPO woodland (Long Established of Plantation Origin), and extend to 103 ha, or 10 percent of the enclosure. They are not formally listed as LEPO as such, but they have this character. Most of the trees present date from 1920 or 1930, with one sub area dating from 1950. It is apparent from the trees present that they were part of a much more extensive woodland planting, and there is a map in Appendix 4 showing this extent in 1930, so a considerable area of trees must have been felled at some point after that and not restocked, leaving those which were much younger, or perhaps more difficult to access.

The trees are mostly Scots Pine, with a proportion of native broadleaves. Three small sub compartments comprise mixed conifers, but these are a small proportion of the total. Appendix 4 gives a fuller description of this area. Estate records record that Scots Pine seed was collected from old growth forest on "east Binion" in the 1870's, to produce seedlings in their own nursery, so it appears that these trees are from genuine local provenance, collected from one of the hills themselves. In summary, these woods are planted, but they have been in the landscape for a century and the wider area for longer, they comprise almost entirely native species, and could be used to create pinewood regeneration both down to the loch, and also up to a significant altitude on both sides. Enclosing these areas would allow development of suppressed woodland vegetation, presuming that this exists at least to some extent, it would allow regeneration within the woodland area, some of which is relatively open, and these trees would be the seed source for pinewood extension on to adjacent ground.

The hatched areas on the map indicate those areas where regeneration is likely from native seed sources, either the ancient woodland, or the Scots Pine trees. A conservative estimate is that there would be approx. 100 hectares of natural regeneration, covering 9% of the area of the enclosure. This is in addition to that regeneration that may occur within the extent of the ancient woods, and the more open areas of the pine plantations. The likelihood is that a proportion of regeneration will extend beyond the 100 ha suggested.

Tree regeneration would be confined to Binnein Shios, and Creag a Chuir, with a much reduced possibility of regeneration on Binnein Shuas due to lack of obvious seed source, although fragments of native woodland will undoubtedly be present on the mountain. One small area of ancient woodland also exists in the saddle between the two Binneins, and this too should regenerate when enclosed.

Shown on the map in purple is the 68 ha of plantings proposed by SLR Consulting Ltd, designed primarily to help landscape different aspects of the construction. Areas 1 & 2 lie outwith the main fenced enclosure, and these five, small individual woods will need to be individually fenced. They are situated in order to screen the main construction track so that this is not visible from the main road as it approaches the skyline

In summary then, enclosure without any planting should see woodland improvement or development extending to 330 ha, or 31 percent of the area of the enclosure.

Planting Options

Careful consideration has been given to what area of woodland might be planted within the area, and what type of woodland this might be.

It will be possible to plant a limited area of native woodland using conventional mounding and planting, at lower levels where soils are suitable and in areas where machine access is possible. Above this, there will be planting zones where trees will grow, but where machine access is not possible, and all trees will have to be hand screefed. The logistics of this are more difficult, but this can be mitigated by reducing the stocking density, and having a more open woodland in these areas. It is suggested that such plantings could be extended up to the 500 metre contour or so. Above this, ground conditions will be much more difficult, but this is the area where we might want montane shrub species to grow. The proposal is that planting density per hectare is further reduced in these areas.

In this way, woodland would be established to the top of the hills, becoming more open with altitude, with 3 X zones defined for planting prescriptions. These zones are marked on the map above.

It is important to note that as it is not intended to apply for Forestry Grant Scheme (FGS) funding or carbon credits, that there is a flexibility in planting density and design, as long as any woodland created is in keeping with the site and recognized best practice. However, what is suggested will be recognized by all involved with woodland creation in Scotland.

Zone 1

There is a large area to the west of Binnein Shuas where ground prep machines could get easy access for conventional woodland establishment, with a much smaller area to the west of Binnein Shios. No such ground exists on Creag a Chuir.

These two areas extend to 116 ha in total or 11 percent of the enclosure area. However, there are certainly areas of wetland habitat, peatland or other carbon rich soils within this area, and that it is likely that perhaps only 50-60% of this ground is practical to plant, say 60 ha.

This woodland would therefore be open, covering half the ground, and avoiding sensitive habitats.

It is unlikely that there is a significant area of ground that might grow oak/ hazel or other species requiring better ground, so it is suggested that a very simple mixture of downy birch, rowan and mixed willows is used, with more willows than might normally be the case. 5- 10 percent Scots pine could also be incorporated in the planting mixture. The priority for these areas will be to create woodland cover quickly, and provide for a seed source which might then provide for subsequent regeneration within the wider area.

While the current planting density for native woodlands is 1600 trees per ha (2.5 metre average spacing), the proposal here is to plant at 1100 trees per ha (3 metre spacing). Although this means that the trees will take longer to close canopy, they will have space to grow fuller crowns, and that will increase their ability to produce seed in the longer term.

Ground survey will determine what proportion of the site it is possible to plant, but for planning purposes, we will suggest 60 ha in total, planted at 1100 trees per ha.

Zone 2

Much of the hill area will not be possible to access with machinery, even well below montane levels.

The proposal here is that up to 500 metres in elevation or so, that a zone be planted with low density woodland. The target density will be 500 trees per ha, but 625 trees per ha will be planted to try and avoid the need for any subsequent beating up.

The species will be the same as Zone 1.

Trees will need to be hand screefed. It is suggested that sensitive habitats are less likely to be found within this zone, with planting niches constrained mainly be areas of rock and very thin soils. It is unlikely that this can be mapped in detail. Planters will therefore be asked to select their own planting areas, retaining the 3 metre planting distance, but only covering c 40 percent of the area, perhaps in groups of 20-50 trees, in the most appropriate areas. There would need to be a strong emphasis on individual planting choices and overall supervision, but this will create a woodland that is as random as possible, while hopefully choosing the better micro-sites. It is possible that such trees will need to be fertilized. Planting 625 trees per ha allows that some mortality can be tolerated to reach the target density, and avoid follow-up remedial work.

Again, this planting will be concentrated mostly on Binnein Shuas, a lesser area on Binnein Shios, and nothing on Creag a Chuir.

This zone extends to about 200 ha in total, about 40 percent of this being planted to give a very open, low density woodland.

Zone 3

The opportunity within this scheme is to establish montane woodland, linking this down to lower levels through the previous two zones, and linking this to other woodlands within the wider landscape, including ancient woodlands.

It is very likely that a small proportion of native species will exist at these higher levels already, and a planting prescription will boost the numbers of these.

At this level, a significant proportion of the area will not be possible to plant, either because of rock, very shallow soils, or where the terrain is simply too difficult or dangerous to access.

For this reason, and for reasons of logistics, it is proposed that the planting density is reduced to 200 trees per ha, to comprise entirely montane willow species, and possibly a small proportion of juniper.

The trees would be hand planted, planted in groups of 10-20 at 3 metre spacing, covering 20 percent of the area. There would be an even stronger need to rely on planter initiative, with supervision needing to be of a very high standard.

Planting montane willows is a specialist undertaking, and advice would need to be taken from an early stage, and sourcing suitable seedlings will be more difficult than the other species.

This montane zone, which will start at 500 metres, not 600 metres, will also extend to c 200 hectares, but only 20 percent of the area will be planted. The slightly lower altitude starting point will allow montane species to grow more quickly and give faster impact.

This montane planting will extend across the 3 X hills within the scheme.

For Binnein Shios and Creag a Chuir, it is very likely that any montane planting will be supplemented by regeneration from below, including probably some Scots Pine at these higher elevations. All such regeneration will be accepted, and this will hopefully lead to a natural and diverse mix of tree and shrub species.

Non native tree regeneration

It is very likely that non-native conifer regeneration will arise from the woodland strip along side Loch Laggan, and provision will be required to clear this, possibly every five years or so. However, it is possible that with these trees being to the north of the enclosure, that such seeding will be minimal. It is not possible to quantify this in advance.

Other

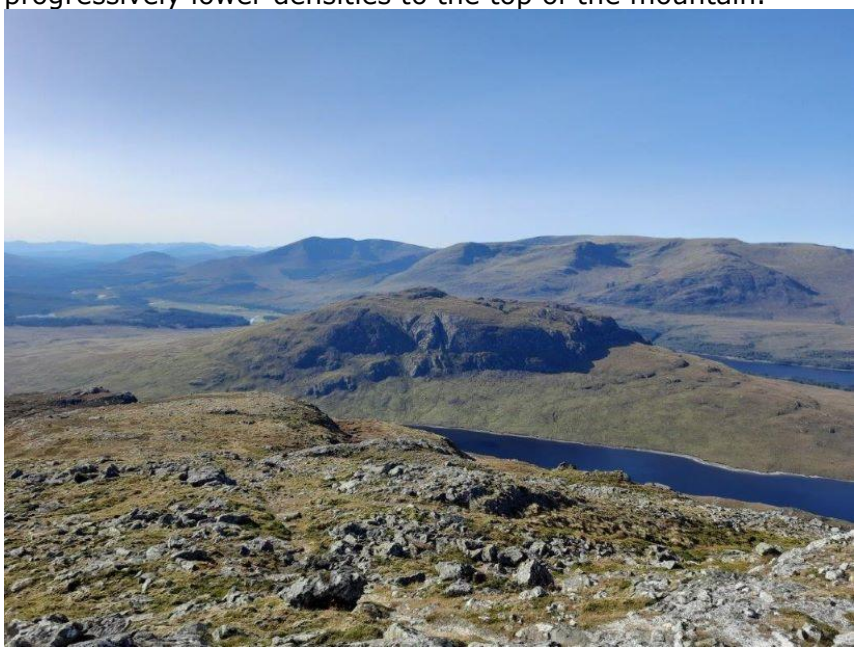
Any additional areas of planting, such as those envisaged by SLR Consulting Ltd can be undertaken as ground conditions allow, and these areas may provide the opportunity for a diversification of species beyond just birch and willows.

The fenceline can be adjusted to accommodate them as required.

Appendix 2 Binnein Shuas

The purpose of Appendices 2-5 is simply to give a feel for what the area looks like in real life, and to point out some aspects of what is envisaged.

This is the west end of Binnein Shuas. The fenceline will run in the middle ground in this view. Only about 50 percent of this ground would be possible to plant, with areas of wetland like this and areas of blanket bog to be avoided. The intention however is to take a relatively open woodland to the base of the hill, and then under progressively lower densities to the top of the mountain.



Binnein Shuas from the top of Creag Pitridh. Stand- alone hill, extending to nearly 750 metres, it is easily accessed, but spectacular within the landscape.

Looking from the top of Binnein Shuas cliffs down to where the Shuas dam will be.

Looking eastwards towards Binnein Shios, with Creag a Chuir in the far distance, in line with the far end of loch with trees on its flank.

Walking up towards the Ardverikie Wall, which is a popular climbing spot. You can see here the sort of terrain in which montane planting would be taking place, avoiding the more peaty areas like that in the foreground.

An example of the sort of vegetation and planting ground that would be available at high level. The ground vegetation is likely to be very responsive if not grazed. Access to the hill top is relatively straightforward as well, and you can see the paths are well used.

Appendix 3 Binnein Shios

This picture of Binnein Shios gives a good indication of where Loch Earba lies in relation to Loch Laggan beyond. The area of land dominated by the 2 X Binneins is only 1- 1.5 kms wide, occupying an area of c 650 ha. The dry land here between the two parts of Loch Earba will be totally submerged. This will remove some valuable grassland habitat for deer. Blocking this route across to the Binneins via inundation would otherwise mean that this piece of land becomes isolated and more difficult to manage for deer. This suggests it would be better managed for a different outcome, as is being suggested here.

Binnein Shios from Creag Pitridh.

These pine trees on the flank of Binnein Shios are a 1920's plantation, with older trees below them having obviously been removed, probably in WW2, and the area never restocked. It is believed that these trees were grown in the nursery at Ardverikie, from seed collected on the same hill, with 34 million having been produced in the late 19th century. There is now an opportunity to let these trees spread, both down to the loch, and upwards towards the top of the hill. Regeneration of this belt of trees would make it look less conspicuous in the landscape. There is no need to plant any of this.

There is a scattering of birch trees along the lower edge of these woods, which will help form a more diversified regeneration mixture. The ground looks very suitable for regeneration.

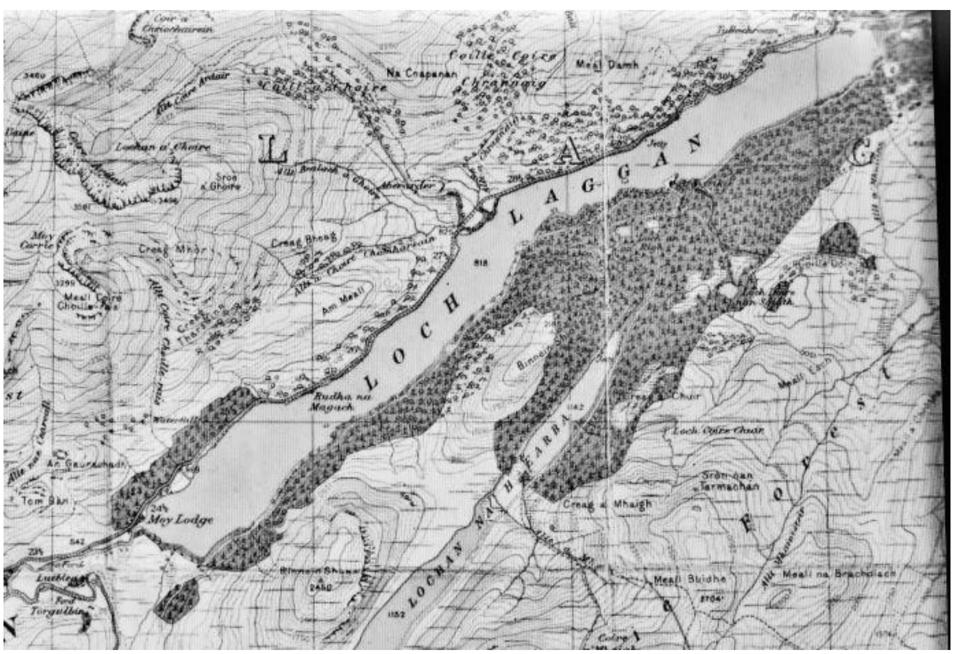
This is at the eastern end of Binnein Shios where the Shios dam is going to be constructed. The woods are thicker at this end, and more dominant in the landscape. The trees at this end are dated from 1950, so much younger than other pine trees around the loch.

Appendix 4 Creag a Chuir

This is Creag a Chuir, with its flank clothed with Scots Pine woodland, dating from 1920's. There is no need to do any planting here, as much of this landscape will fill in once grazing has been removed.

As with Binnein Shios, there is a proportion of native broadleaves within this woodland, which will diversify any regeneration that arises and make for a more attractive, mixed woodland.

This picture shows some of the trees that will unfortunately be lost due to inundation with water. The track will be submerged, and all the ground up to the break of slope. However, the project now provides the impetus to regenerate and expand this woodland within the much wider area.



This map from 1930 shows how much extensive the pinewood plantations were at that time, with a significant contraction of habitat to present. Presumably older timber was felled during WW2. The project will seek to re-instate this pinewood habitat by natural regeneration, and extend native and montane woodland habitats over the Binneins, linking through to the woodland on Corrour to the west.

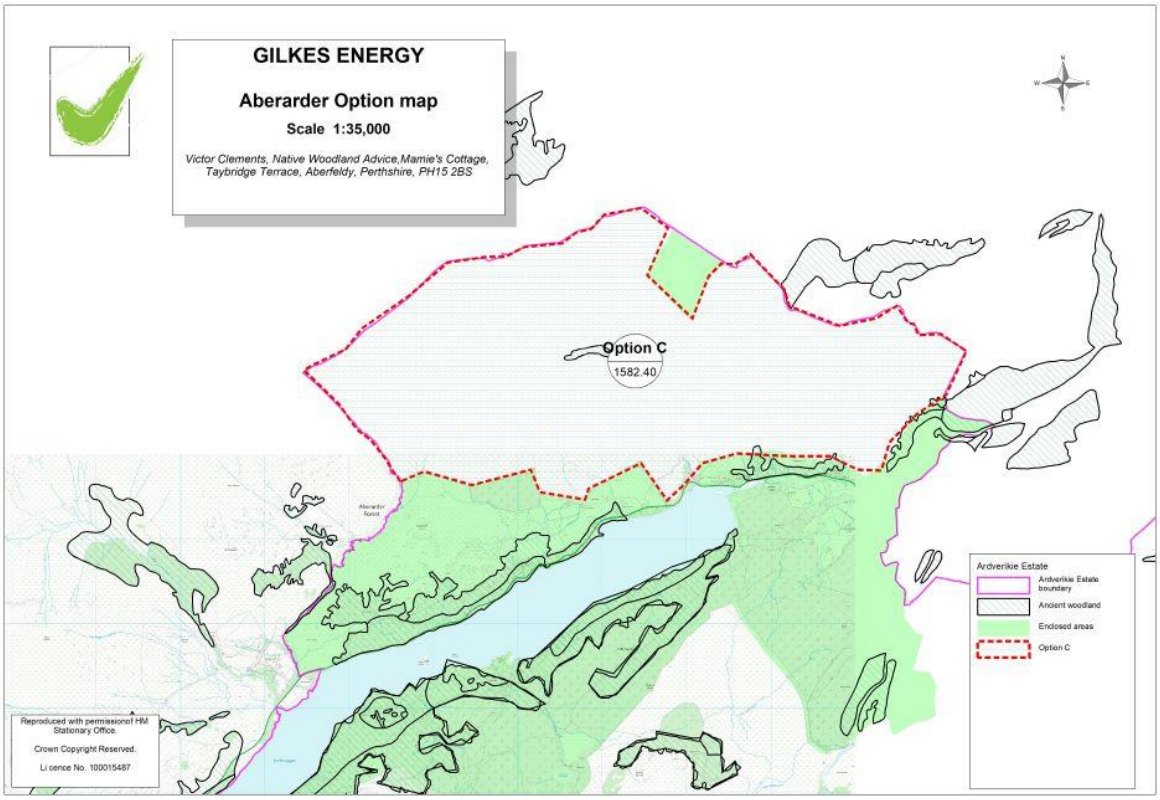
View from Creag a Chuir across towards the saddle between the 2 X Binneins. You can see here that with a southwest wind, the Scots Pine will extend towards the top of the hill.

View from top of Creag a Chuir to east end of Loch Earba, clearly showing pinewood habitat on both sides of the loch.

Looking from Creag a Chuir back towards Binnein Shuas. Gives a good idea of the scale of the woodland restoration project area. The two lochs will become one, and become wider, removing habitat on both sides, including a small area of trees.

Although these trees are planted, they have a very strong native pinewood character, and will regenerate both upwards and down towards the loch.

Appendix 5 Aberarder

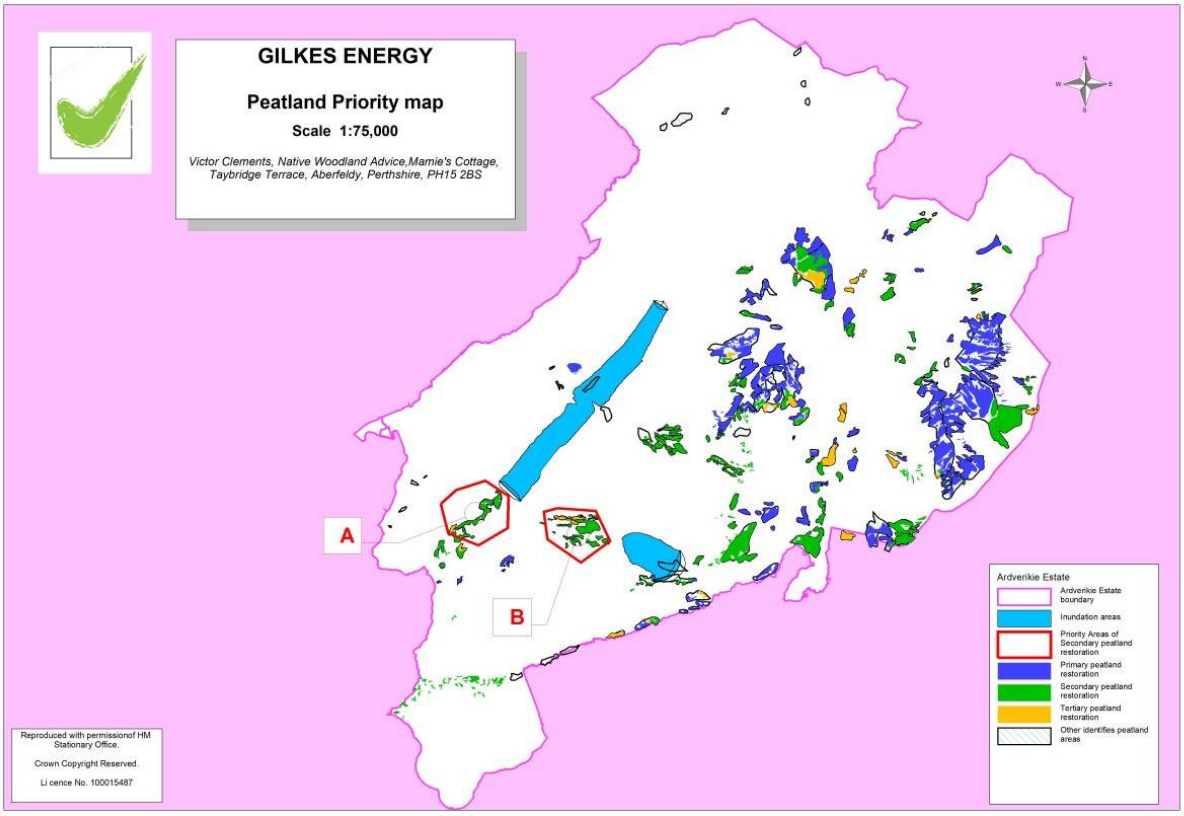


This map shows the open hill area that might be available with which to do something at Aberarder, to the east of the Creag Meagidh NNR. Any project here would be in place of peatland restoration/ woodland restoration around the project area itself, and is not the option being put forwards here. However, consideration was given to this area, and feedback is welcomed.

Above, this photo is from the centre of the Aberarder area looking west, with all the area shown being potentially available. It would be possible to plant a high proportion of this ground, with oak dominated woodland down next to the road, to montane woodland at 3000 ft.

Below, this is the view looking north/ northeast. Again, most of this could be fenced to plant a native woodland. Seed sources are rare, and mostly limited to the lower edge of the area, and therefore, deer control efforts only are likely to be very slow to show results by themselves.

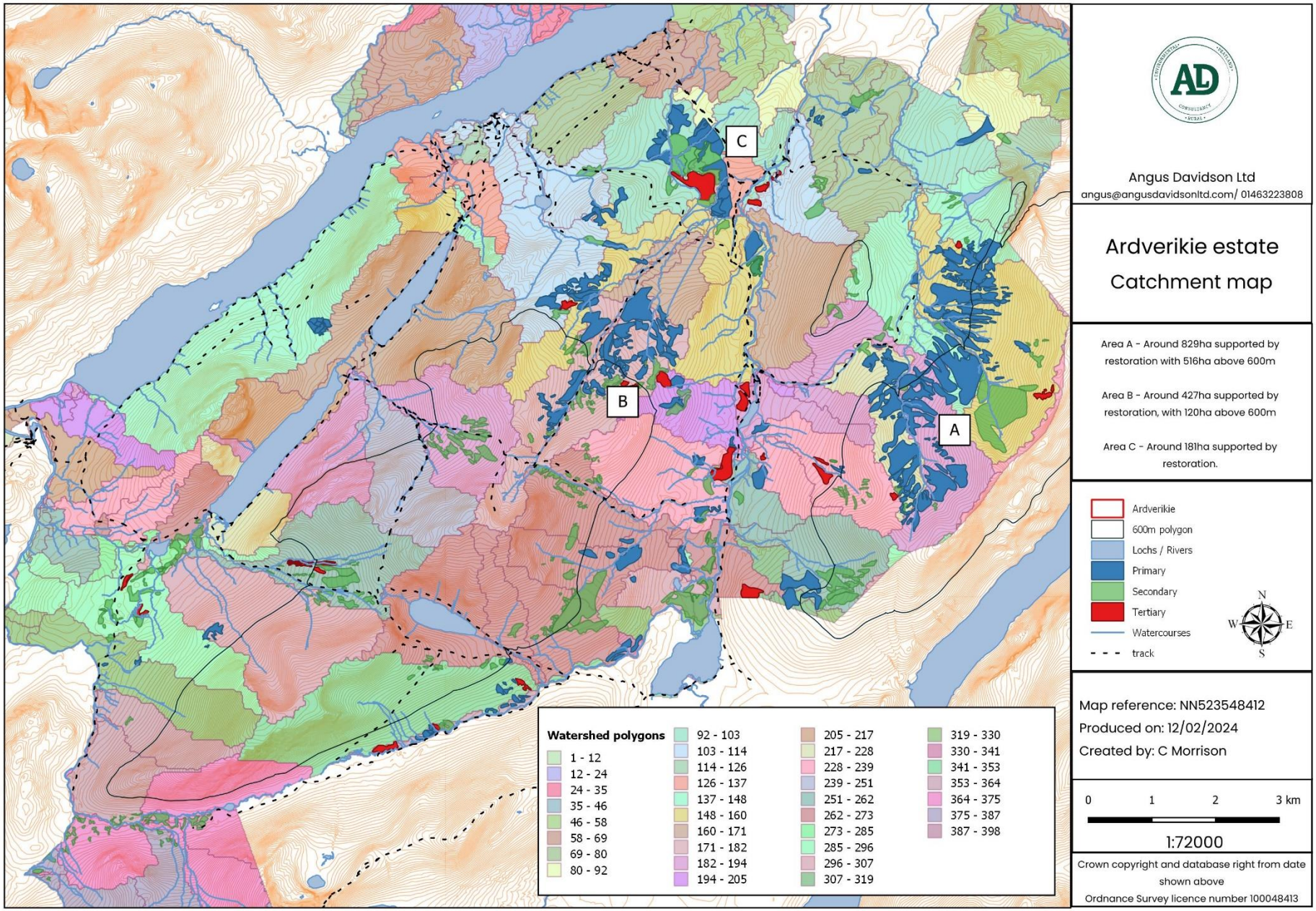
Appendix 6 Peatland Proposals



The broad strategy for targeting areas for peatland restoration is to focus on the areas of primary restoration first (coloured blue here on map above, 571 ha total)), but to include other areas within the same hydrological units in order to bring total area of restoration up to 625 ha. The three main areas of peatland (A-C) will be prioritized in that order, with areas of secondary and tertiary restoration being risk assessed before actual work takes place. Areas of higher risk will be replaced from the next catchment on the priority list and so on until 625 ha has been achieved.

It may therefore be the case that some areas of secondary restoration in key locations will be replace small scattered areas of primary restoration.

On the map above, Areas A & B, different to areas A-C overleaf, will be prioritized for restoration due to their proximity to dam and their potential for making use of excavated peat from the construction area.



Angus Davidson Ltd
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Ardverikie estate Catchment map

Area A - Around 829ha supported by restoration with 516ha above 600m

Area B - Around 427ha supported by restoration, with 120ha above 600m

Area C - Around 181ha supported by restoration.

Ardverikie
600m polygon
Lochs / Rivers
Primary
Secondary
Tertiary
Watercourses
track

N
W E
S

Map reference: NN523548412
Produced on: 12/02/2024
Created by: C Morrison

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REPEAT ASSESSMENT OF HERBIVORE IMPACTS AT THE BEN ALDER AND AONACH BEAG SAC

Draft report

by Colin Wells

15 October 2021

Summary

In 2021 a repeat herbivore impact assessment was carried out for two features, blanket bog and wet heath, within the Ben Alder and Aonach Beag SAC. A total of 83 waypoints were visited and 55 blanket bog plots and 28 wet heath plots were assessed.

Herbivore impacts decreased from 2013 to 2021.

94% of blanket bog plots had Low or Moderate-low browsing impacts and 89% had Low or Moderate-low trampling impacts.

Blanket bog trampling impacts were lowest on Ardverikie with 96% of plots registering Low or Moderate-low categories compared to 84% within the Ben Alder Estate.

Overall, blanket bog browsing impacts decreased in 21% of plots and trampling impacts decreased in 37%.There were also decreases in measured browsing on dwarf shrubs and disturbance by hoofprints.

The results represent a reduction of trampling and browsing impacts in both management areas. There has been a shift in browsing and trampling impacts for blanket bog with more plots moving from Moderate-low to Low impact categories in 2021 than in 2013.

92% of wet heath plots returned Low or Moderate-low browsing impacts and 86% had Low or Moderate-low trampling impacts. Wet heath browsing impacts decreased in 61% of plots and trampling impacts decreased in 25%. Measured dwarf shrub browsing and disturbance by hoofprints also remained stable at low values for wet heaths.

Overall wet heath registered a decline in browsing impacts with a marked shift of plots from the Moderate-Low categories to Low. Wet heath trampling remained almost stable with most plots remaining in the two lowest impact categories and no plots registering higher than Moderate.

Although the rate of reduction on herbivore impacts has been less marked than that recorded between 2008-2013, the current level of herbivore impacts is likely to be sufficiently low to maintain and slowly improve some of the vegetation within the Ben Alder and Aonach Beag SAC.

CONTENTS

1 Introduction

1.1 Background Information

Following results from earlier Site Condition Monitoring exercises by SNH indicating that high populations of herbivores within the SAC and SSSI may potentially be causing damage to notified features, a baseline herbivore impact survey was carried out in 2008 for two features: blanket bog and wet heath (Maier 2008).

This found that impacts were High or High-moderate for more than 20% of plots for trampling and wet heath browsing, though blanket bog browsing impacts were lower with only 5% of plots in these higher impact categories. Impacts were highest for wet heath trampling where 35% of plots were in the higher impact categories.

Following a reduction in deer number and deer monitoring through regular counts, a repeat Herbivore Impact Assessment survey was undertaken to assess current browsing and trampling levels on the same selected features in 2013 as in 2008, using the same methodology. This showed significant reductions in herbivore impacts had occurred (Maier 2013).

The current study builds in these surveys and reports on the results of the third repeat assessment.

2 Methods

Methodology replicated that used previously in 2008 & 2013. Blanket bog and Wet heath with cross-leaved heath were again the features were surveyed within the site. For the former, 55 plots in both management units and for the latter, 28 plots in a single management unit, Ben Alder Estate, were visited and assessed.

Browsing, browsing and trampling impacts were assessed using a range of small-scale field indicators described in MacDonald et al (1998). Blanket bog was assessed using the blanket bog assessment in the field guide and wet heath was assessed using either the blanket bog or the dry heath assessment. The former was used for Wet heath communities M15a and M15b, the latter for M15c and M15d which are usually found on shallower peat and steeper slopes than M15a and M15b. Additional guidance was used from the recent addendum to the methodology (MacDonald 2007).

The random locations were located with a hand-held GPS and at each one the relevant feature was searched for within a 20-metre radius and assessed if it was present. A new ten figure grid reference was recorded if the plot was moved from the supplied grid reference. Grid references denoted the SW corner of the plot, which was orientated N-S and E-W with the National Grid. Plot size was $4m^2$ (i.e. 2m x 2m) for most targets, though some were assessed on a ‘visible’ scale or for the whole feature. Dung was assessed for a 10m by 10m plot centred on the smaller plot.

The NVC community present at each plot was recorded in order to identify the appropriate indicators to be used (see table 1).

Table 1. Relevant NVC communities and habitat assessment forms used for each feature.

Feature assessed	Habitat assessment used	NVC community

Blanket bog	Blanket bog	M17-M20
Wet heath on deeper peat	Blanket bog	M15ab
Wet heath on shallow peat	Dry heath	M15c, M15d

For each plot current herbivore trampling and browsing impacts were assessed using the appropriate small-scale browsing and trampling indicators from MacDonald et al (1988). Impacts were recorded as H -High, M - Moderate or L - Low or as intermediate HM or ML when appropriate. If an assessment could not be carried out because it referred to plant species not present, the impact was recorded as NA – not applicable. U – Uninformative was recorded where indicator assessment would not be meaningful.

To make an overall assessment for each plot, High impact results were scored 3, High to Moderate impacts 2.5, Moderate impacts 2, Moderate to Low impacts 1.5 and Low impacts 1. The combined scores were then averaged to give an overall score that was reclassified as follows:

0-1.249	Low
1.25-1.749	Moderate to Low
1.75-2.249	Moderate
2.25-2.749	High to Moderate
2.75-3	High

Previously semi-subjective 'trend indicators' were recorded in order to predict possible directions in habitat condition (Macdonald 1998). SInce these are necessarily imprecise measures and as the 2021 assessment now allows a of three robust datasets they have been superseded by direct comparison of the results to give actual measures of trends rather than perceived/predicted directions of travel. For each pair of assessments the direction of change, either increase, decrease or unchanged, was therefore determined.

Additional measures recorded for blanket bog assessments included estimating the percentage cover of the plot disturbed by hoof prints, bare peat and re-vegetating peat. The percentage cover of browsing on long shoots of *Calluna vulgaris* and *Vaccinium myrtillus* was recorded for all plots of both habitat types and this was estimated based on an average assessment of ten handfuls of shoots. Average dwarf shrub vegetation heights were recorded based on ten measurements taken in each plot.

Nomenclature in this report follows Stace (1997) for vascular plants, Atherton *et al* (2010) for mosses and liverworts, and Coppins (2002) for lichens.

3 Results

83 waypoints were revisited and assessed (Map 1).

Charts 1-4 shows the total percentage of plots recorded for each impact class for each habitat in the Ben Alder and Aonach Beag SAC. The average browsing, trampling and dung assessments made for each waypoint in each management unit are shown in Charts 5-6 & 9-10 and illustrated in Maps 2-3.

In the following sections browsing and trampling impacts are described separately for each habitat feature.

3.1 Blanket bog

3.1.1 Habitat description

The characteristics of the blanket bog vegetation present within the site have already been described in the previous report (Maier 2013) and no significant changes were noted.

3.1.2 Browsing impacts

Almost all plots, 94%, had either Low or Moderate-low blanket bog browsing impacts (Chart 1). Only 4% had Moderate browsing impacts and 2% High-Moderate. This represents a further decline in browsing impacts since 2013 (Chart 7).

Browsing impacts were lowest on Ardverikie with all of plots in the Low or Moderate-low impact categories (Chart 4). On Ben Alder Estate just over half, 61%, of plots were in the Low category 27%, in the Moderate-low category and 12% in the High-moderate or Moderate categories (Chart 5).

3.1.3 Trampling impacts

89% of blanket bog plots had Low or Moderate-low trampling impacts 9% had Moderate trampling impacts and 2% High-Moderate (Chart 2). This again indicates a decline in impacts since 2013 (Chart 8).

Overall trampling impacts were lower on Ardverikie, with 52% of the plots in the Moderate-Low impact category and a 44% in the Low impact category, the remaining 4% being Moderate (Chart 8). On Ben Alder Estate a similar proportion of plots recorded Low impacts (46%) but there were more Moderately-impacted plots (14%) and some High impacts (2%). The remainder lay in the Moderate-low impact range (38%). (Chart 6.)

3.1.4 Quantitative measures and dung counts

The average percentage of blanket plot area disturbed by hoofprints per plot was 4.75% for the whole site. It was higher for Ardverikie Estate where 6% of the surface was disturbed compared to 3.2% for Ben Alder (see table 1).

Table 1. Quantitative blanket bog measurements for both management units. (Quantitative measures recorded (*bare and revegetating peat, Average percentage of browsing on Calluna and Vaccinium myrtillus*)

	Average percentage quantitative measures blanket bog (2013 values in brackets)	
	AK	BA
Hoofprints	6 (2.7)	3.2(6.1)
Bare peat	2.3(2.2)	0.9(1.7)
Revegetating peat	0.85(4.4)	0.86(1.4)
Calluna browsed	3.6(11.8)	5(6.9)

Vaccinium myrtillus browsed	11.5(16.3)	16.1(9.0)
Vegetation height	9.9(13.8)	17.9(20.5)

The average bare peat cover per plot for the whole site was 1.6%. On Ardverikie it registered 2.3% which is nearly the same as 2013 (2.2%); on Ben Alder it was 0.9%, nearly half of that recorded in 2013 but in a similar order of magnitude (1.7%). Revegetating peat covered an average of 0.85% of plots on Ardverikie (compared to 4.4% in 2013 and 0.86% of plots on Ben Alder (compared to 1.4% in 2013).

Browsing on *Calluna vulgaris* was lower on Ardverikie with an average of 3.6% (12% in 2013) compared to Ben Alder estate with an average of 5% (7% in 2013), both representing reductions in browsing since 2014, most markedly on Ardverikie. Browsing on *Vaccinium myrtillus* was also lower on Ardverikie with 11% (16% in 2013) versus 16% over the Ben Alder Estate plots (9% in 2013).

At 9.9 cm the vegetation height in the montane blanket bog on Ardverikie remains lower than on Ben Alder Estate (17.9 cm) almost certainly due to more plots being located at more exposed and higher elevations compared to the Ben Alder samples, rather than browsing.

3.2 Wet heath

3.2.1 Habitat description

The characteristics of the wet heath vegetation present within the site have already been described in the previous report (Maier 2014) and no significant changes were noted.

3.2.2 Browsing impacts

The most widespread browsing impact category was Low, with 58% plots falling into this category (Chart 9). A further 34% had Moderate-Low browsing impacts and 8% had High-Moderate browsing impacts.

3.2.3 Trampling impacts

Over half of wet heath plots had Moderate-low trampling impacts nearly a third recorded low ones (Chart 10). The remaining 14% had Moderate trampling impacts.

3.2.4 Quantitative measures and dung counts

Hoof prints were less widespread and obvious in wet heath plots than in blanket bog plots assessed with the same guidance. The average percentage of disturbance by hoof prints was 2.8% - nearly unchanged from 2013 (2.7%). (Table 2.)

Disturbance by hoof prints was not measured quantitatively for wet heath plots assessed with the dry heath guidance. Bare or revegetating peat was only present in a few plots, mostly at very low levels of 1-2% except for one plot (No 80) in the Bealach Dubh which contained an old deer track and which was also the only wet heath plot to register significant levels of bare peat within a wet heath plot in 2013.

Table 2. Quantitative measurements for wet heath (2013 values in brackets)

	Mean	Mean
Calluna browsed	4.5	(15.4)
Vaccinium myrtillus browsed	15.9	(10.5)
Vegetation height	16.5	(16.6)
Hoofprints	2.8	(2.7)
Bare peat	0.7	(0.6)
Revegetating peat	0.23	(0.3)

Browsing on *Calluna vulgaris* was 4.5% (15.4% in 2013) in wet heath plots while browsing on *Vaccinium myrtillus* rose from 10.5 to 15.9%.

Vegetation in blanket bog assessed plots was slightly shorter at 14.2cm versus 16.5 cm in wet heath plots which was broadly comparable to previous results. Dwarf shrub cover was often low in both types of plots and the vegetation was usually dominated by *Molinia caerulea* at lower altitudes and *Trichophorum cespitosum* in higher altitude plots.

3.4 Comparison with previous survey and indicative trends

3.4.1 Browsing and trampling impacts

Impact levels decreased markedly from 2008 to 2013 (Maier 2014) and have continued to decline since then, albeit at a reduced rate of change. Both habitats returned impact results that were predominantly skewed towards the lower categories (Charts 7-8, 11-12).

There has been a shift in browsing and trampling impacts for blanket bog with more plots moving from Moderate-low to Low impact categories in 2021 than in 2013. A very small increase in High-Moderate browsing categories was also registered for this habitat (Charts 7-8).

Wet heath registered a decline in browsing impacts with a marked shift of plots from the Moderate-Low categories to Low. As with blanket bog, there was a small increase in numbers of plots recording High-moderate impacts (Chart 11).

Wet heath trampling remained almost stable with most plots remaining in the two lowest impact categories and no plots registering higher than Moderate (Charts 10, 12).

Those plots recording the highest browsing were mostly located in the extreme north-east of the SAC close to Loch Pattack and the Culra track around Coire Sròn an Nid (Map 2). Similarly higher trampling impact plots tended to be concentrated in the north-east part of the SAC near Loch Pattack and around Coire Sròn an Nid, although scattered plots with Moderate impacts were also recorded more widely with occasional outliers in the central part of the site near Loch an Sgòir, in the higher corries of Ardverikie, and a few in the south-west of the SAC (Map 3).

Just over fifth of plots (23%) recorded High-moderate dung counts and the remaining 77% recorded Low ones. This marks a shift to lower dung counts from 2013 when two fifths of plots were recorded as High-moderate. Dung levels were highest in the north-east of the SAC and towards the south-west (Maps 6,7).

3.4.2 Indicative impact trends

Data recorded in both 2013 and 2021 can be used to illustrate the changes in impacts for each individual plot (Maps 4,5).

More plots had decreasing impacts than increasing ones (Charts 13, 14). Around a third of all plots had decreasing impacts for browsing (34%) and trampling (33%). 19% of plots registered increased browsing impacts and 25% had increased trampling ones.

The highest percentage of impact decreases since 2013 was for wet heath browsing where 61% of plots showed a decrease (Chart 15) and for blanket bog trampling where 37% of plots showed decreases (Chart 17). Interestingly, these were also the two measures that showed the steepest declines in impacts in 2013 from the original 2008 assessment.

The highest percentages of increased plots were recorded for wet heath and blanket bog trampling with 25% and 26% respectively (Charts 16, 18).

Although there is no clear-cut pattern with increased impact plots scattered across the samples, there is a discernible cluster towards the edges of the site, particularly toward the north-east and north-west.

However reduced impacts are also recorded widely and the north-west part of the site also displays a marked cluster of samples registering these (Maps 4,5).

Both increased and decreased impact scores however overwhelmingly do not show marked shifts in magnitude, typical scores registering a change from ML to L or L to ML for example, while 47% of all habitats registered no impact change for browsing and 42% for trampling (Charts 13,14).

3.4.3 Quantitative measures

A comparison of the quantitative data recorded in 2013 and 2021 shows either clear decreases or stability in average values recorded for trampling and browsing indicators, while vegetation heights have remained broadly similar.

Average browsing of *Calluna* was reduced from ca. 9% to ca. 4% to for blanket bogs and 15% to 5% for wet heaths. Browsing on *Vaccinium myrtillus* remained close to stable on blanket bogs at ca. 14% compared to ca.13% in 2013. Disturbance by hoofprints remained stable at around 4-5% for blanket bogs 2-3% for wet heaths while bare peat remained stable with an average cover well under 2% for all habitats. The exception to these downwards or stable trends was wet heath browsing on Ben Alder, which increased to ca. 16% from ca. 11%

3.4.4 Dung

Dung counts have decreased since 2013 (Maps 6.7). Over much of the SAC within Ben Alder Estate the distribution of Low or High-moderate plots has remained broadly the same, with Low values predominating and higher values mostly occurring in the north-east and south-west marches.

The Ardverikie plots however show a marked decline in dung counts. In 2013 over half the sample sites returned High-moderate values but in 2021 this had declined to just two plots.

3.5 Herbivores

The only widespread herbivore recorded was red deer athough they were seen infrequently with ca. 40 hinds with some stags noted near Loch an Sgòir. Deer dung was present in or near many plots, though dung levels in plots have decreased. Red grouse were also present in some areas dominated by *Calluna* but numbers were low in the two features assessed for herbivore impacts.

Ponies were browsing the grasslands on the shore of Loch Pattack and along the Allt a'Chaoil-reidhe. They may contribute to the browsing pressure on wet heath on the Culra track margins but most of their browsing impact is confined to grasslands.

4 Conclusions

Herbivore impact levels were lower in 2021 than they were in 2013, continuing the downward trend from the initial assessment cycle in 2008 (Maier 2013). This is reflected in the recorded overall impact categories as well as for most quantitative values from all assessment years.

The highest impacts are now restricted mostly to the periphery of the SAC, mainly the north-east part of the site close to Loch Pattack in the case of browsing, and the north-east and south-west in the case of trampling.

Dwarf shrub browsing levels are probably still too high to allow any rapid dwarf shrub expansion in graminoid-dominated areas but the data suggests no reduction in dwarf shrub cover. Dwarf shrub height has remained similar.

As was the case in 2013, the evidence suggests that the vegetation on Ben Alder Estate has changed less than Ardverikie since the previous assessment. This reflects the fact that this part of the SAC was already in better condition, with higher impacts that have largely decreased and with the vegetation is now unlikely to deteriorate under current herbivore impacts. The long-term prognosis for Ben Alder Estate is good, though any improvements in habitat condition are likely to be slow. Revegetation of the bare peat areas in the Caol Reidh for example, may require complete exclusion of herbivores in order to be successful.

On Ardverikie, changes in impacts continue to be more noticeable. Despite the fact that many of the blanket bogs are situated in the montane zone, and have characteristics similar to snow-bed and hence are particularly susceptible to trampling impacts, there are markedly more plots indicating reductions in trampling impacts than increases. The reduction in dung counts within the estate boundaries is also striking.

This evidence suggests that current herbivore impacts on Ardverikie are sufficient to maintain the vegetation in its present state and possibly allow further recovery.

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Appendix 1 RESULTS CHARTS

Chart 1

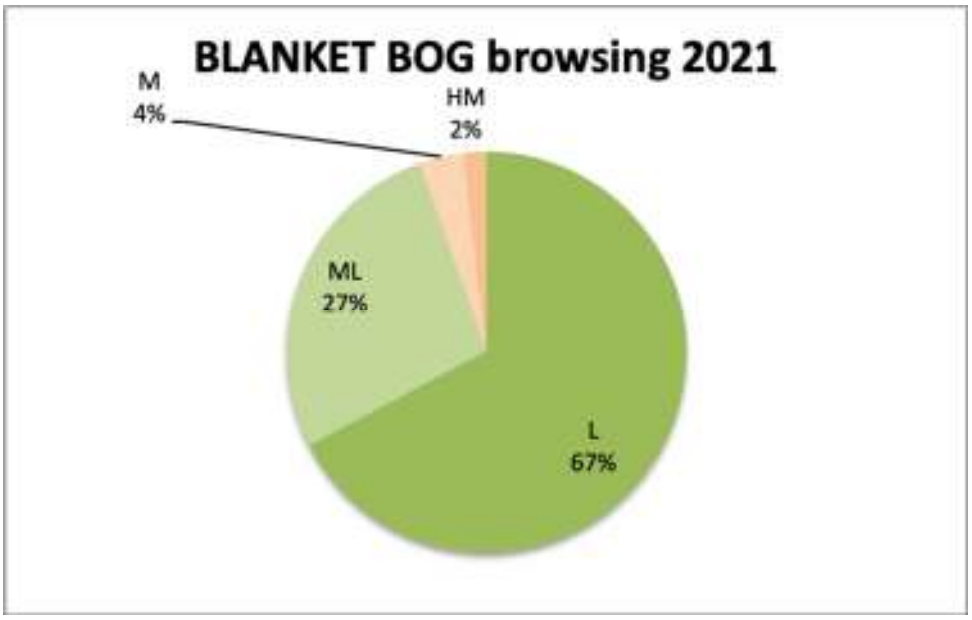
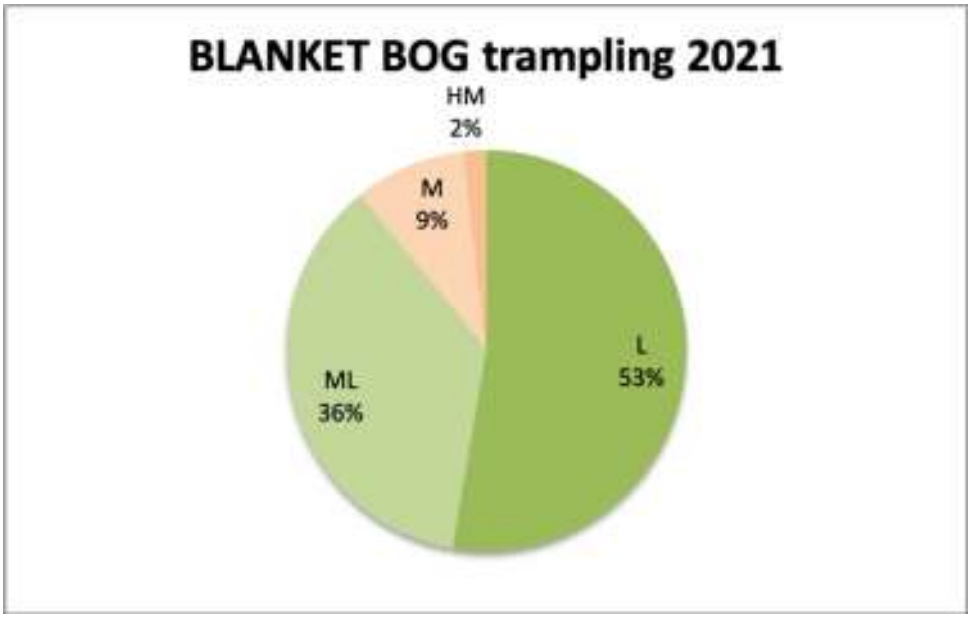


Chart 2



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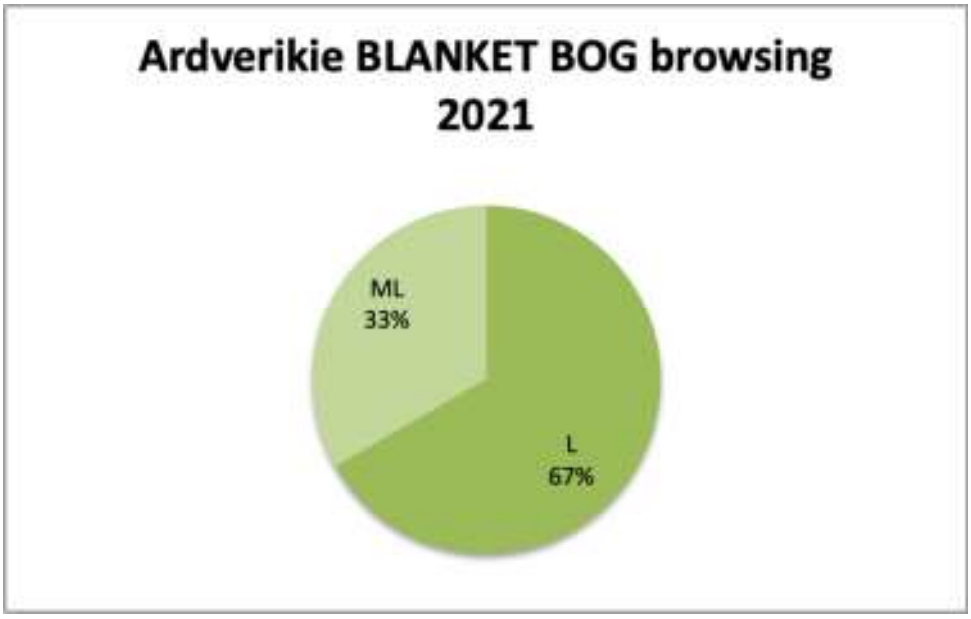

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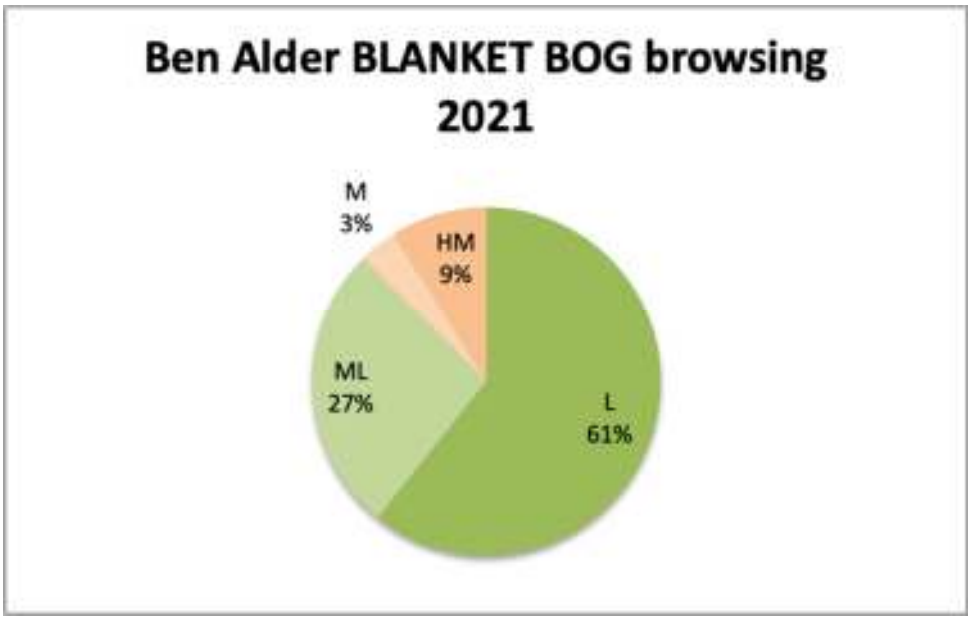

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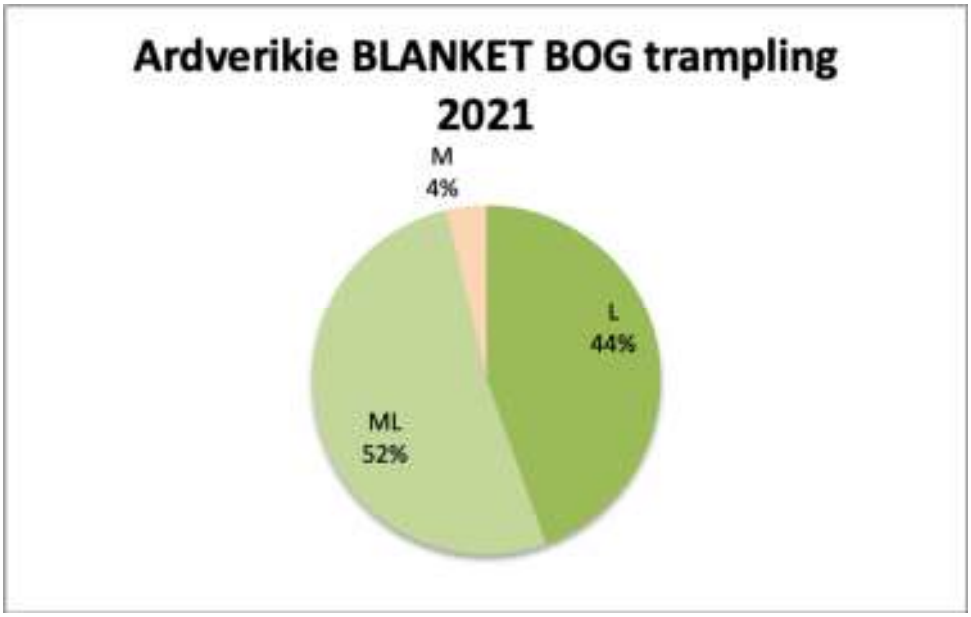

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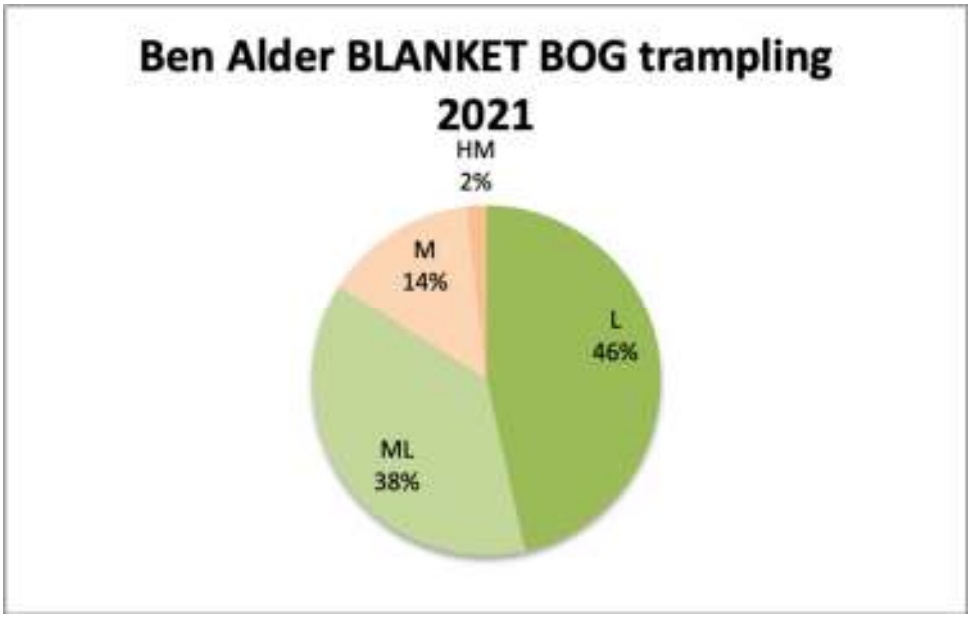

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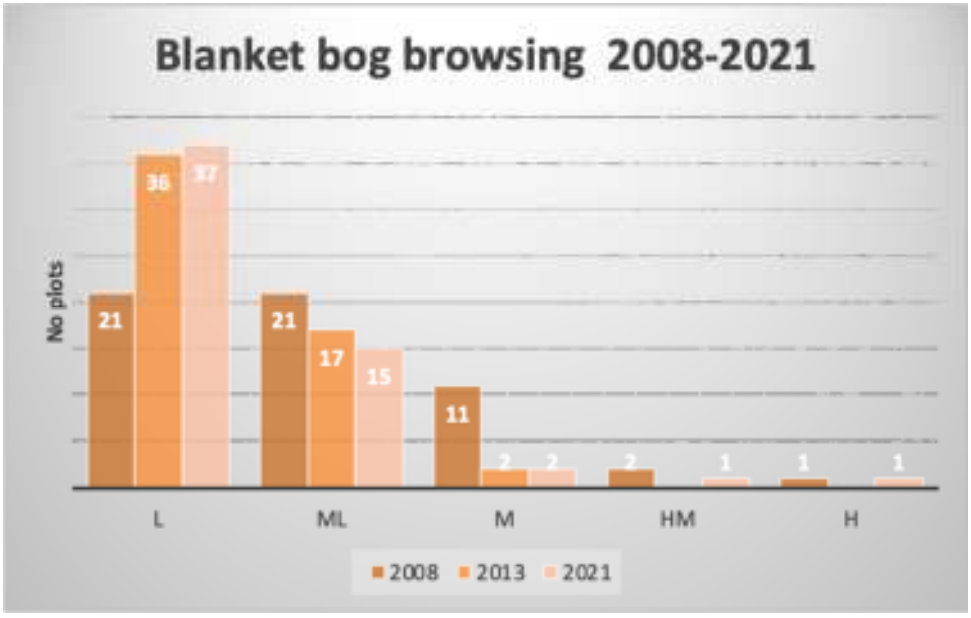

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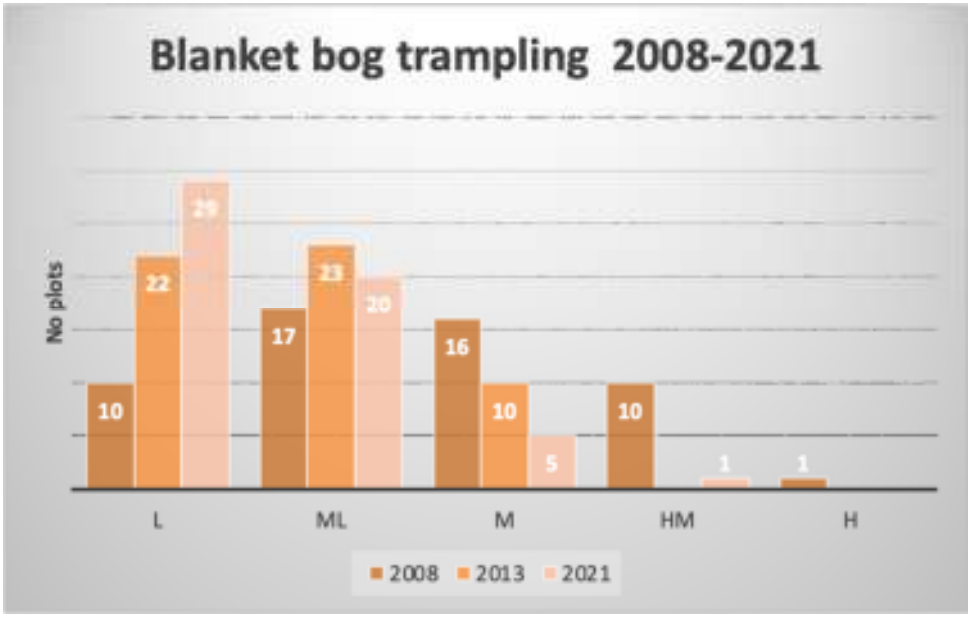


Chart 9

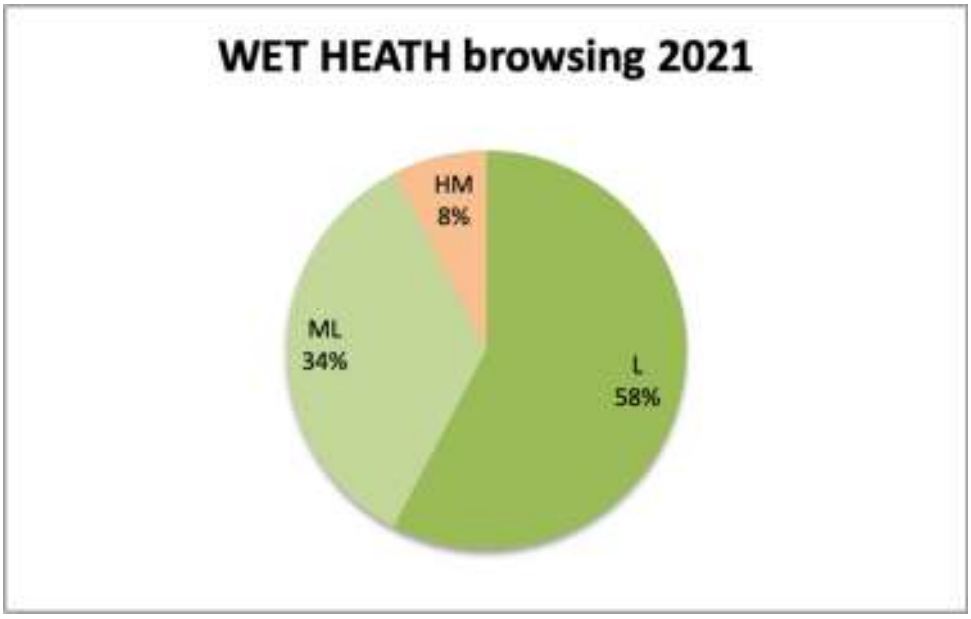


Chart 10

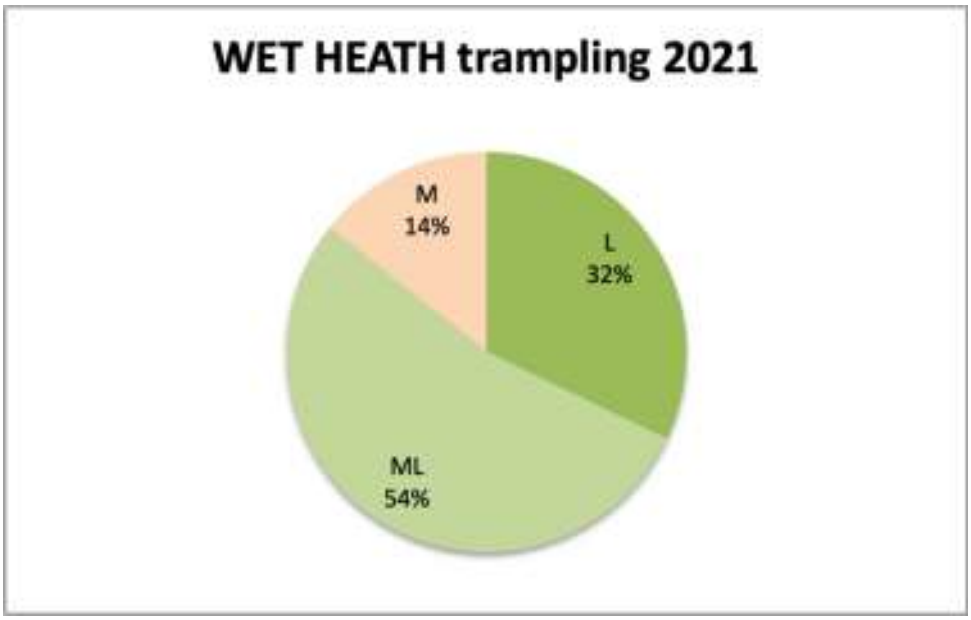
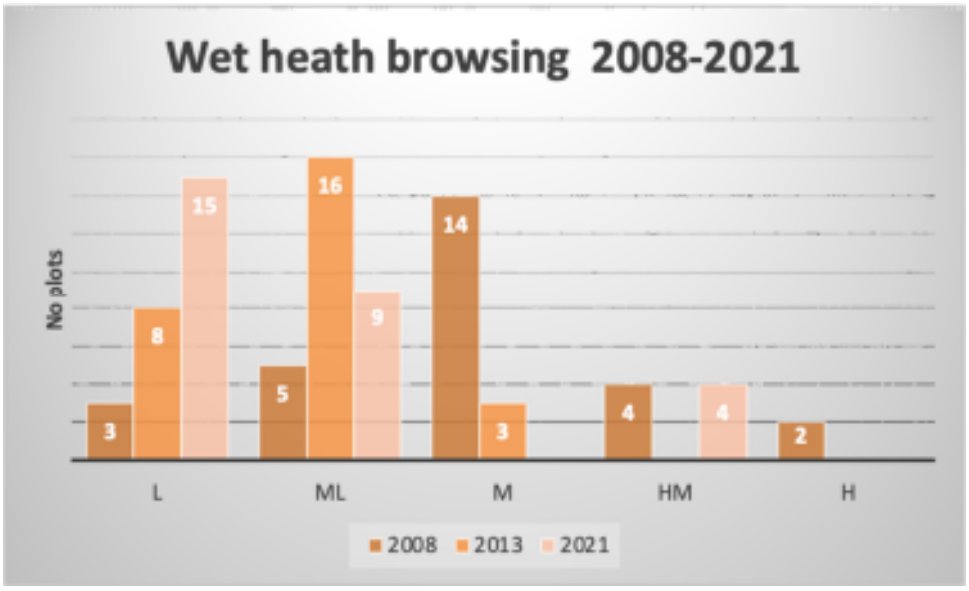


Chart 11



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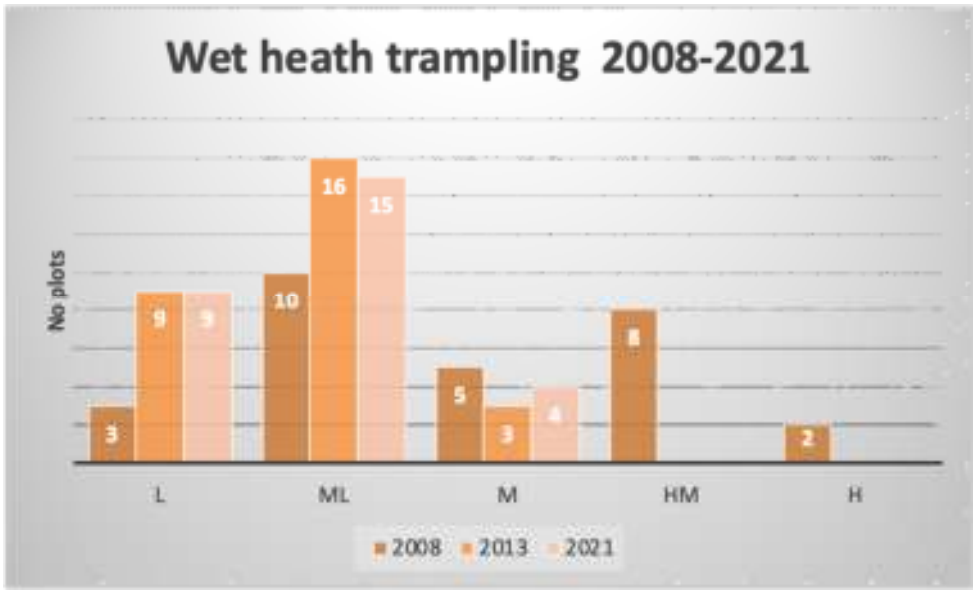


Chart 13

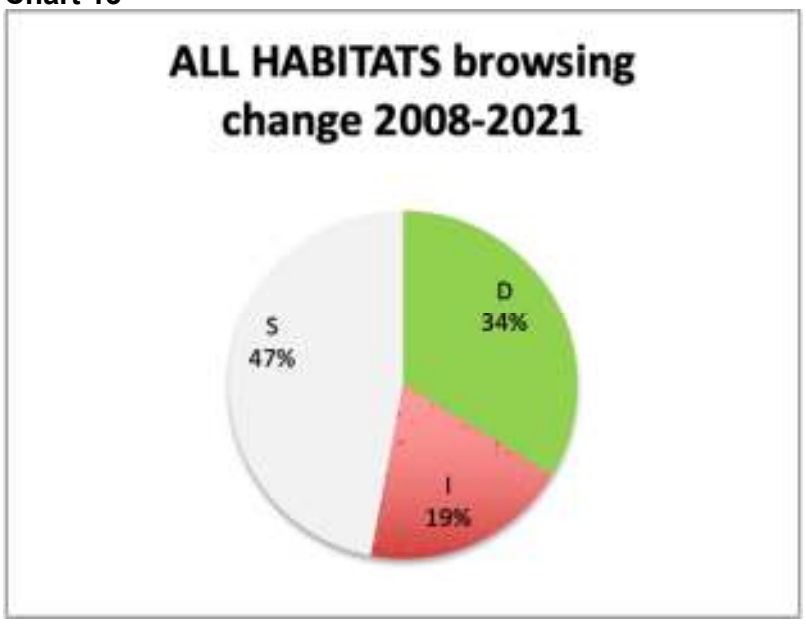
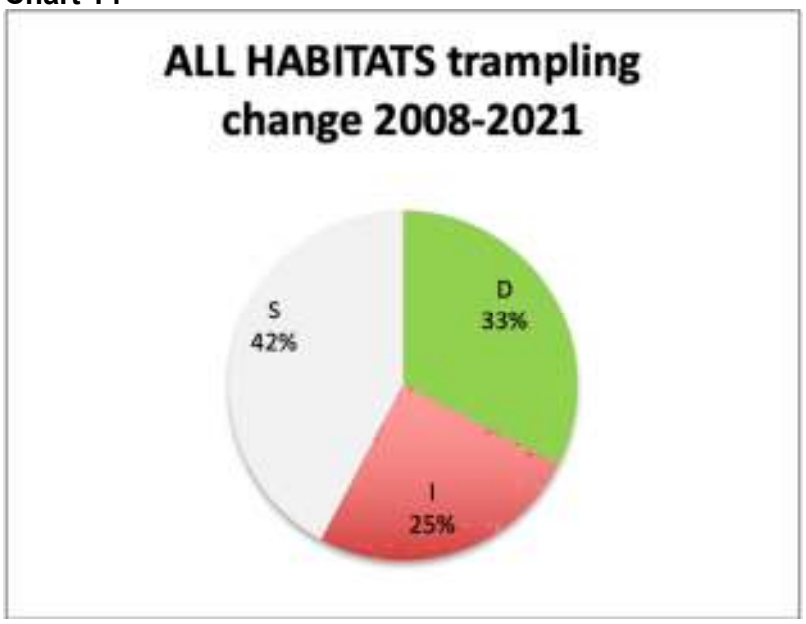


Chart 14



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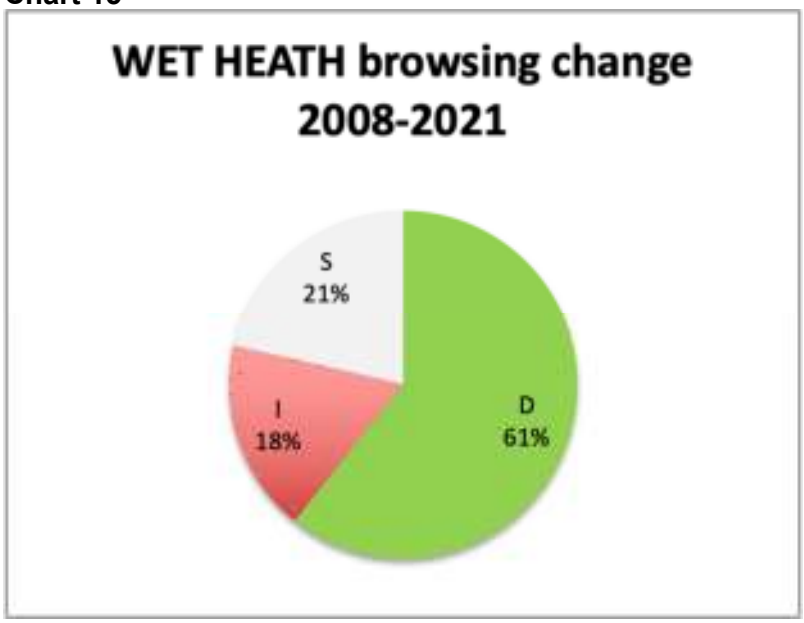

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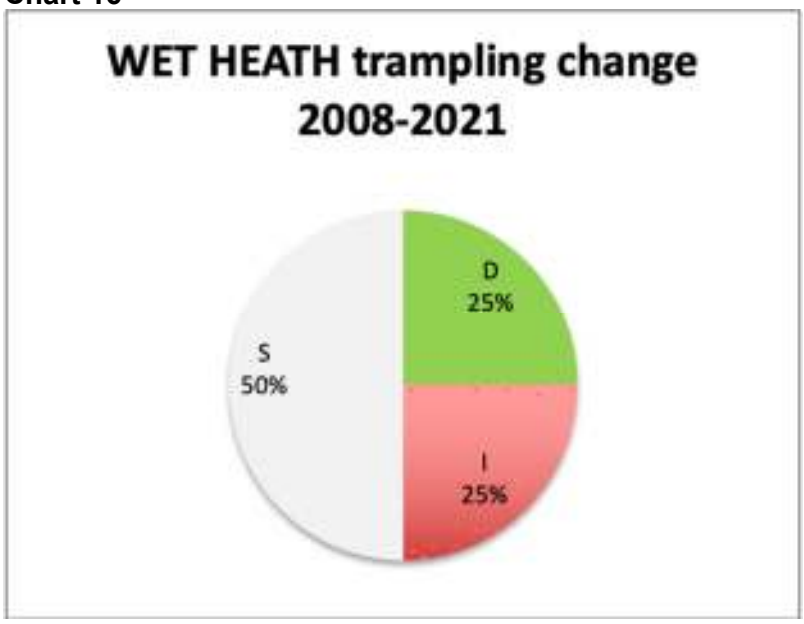

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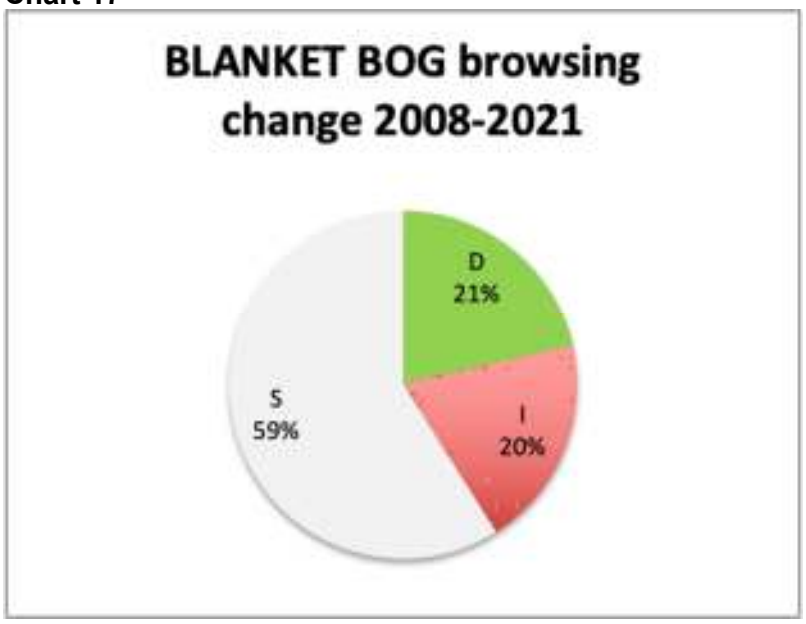
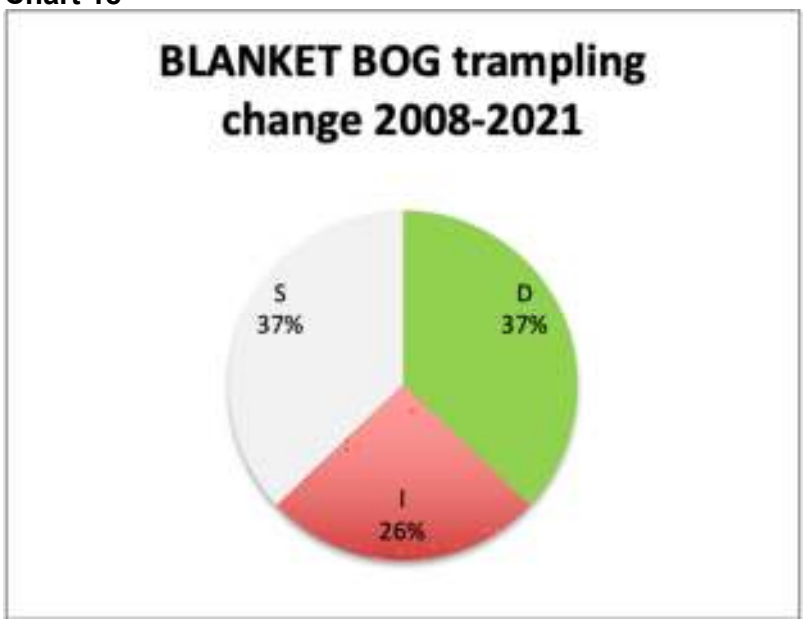
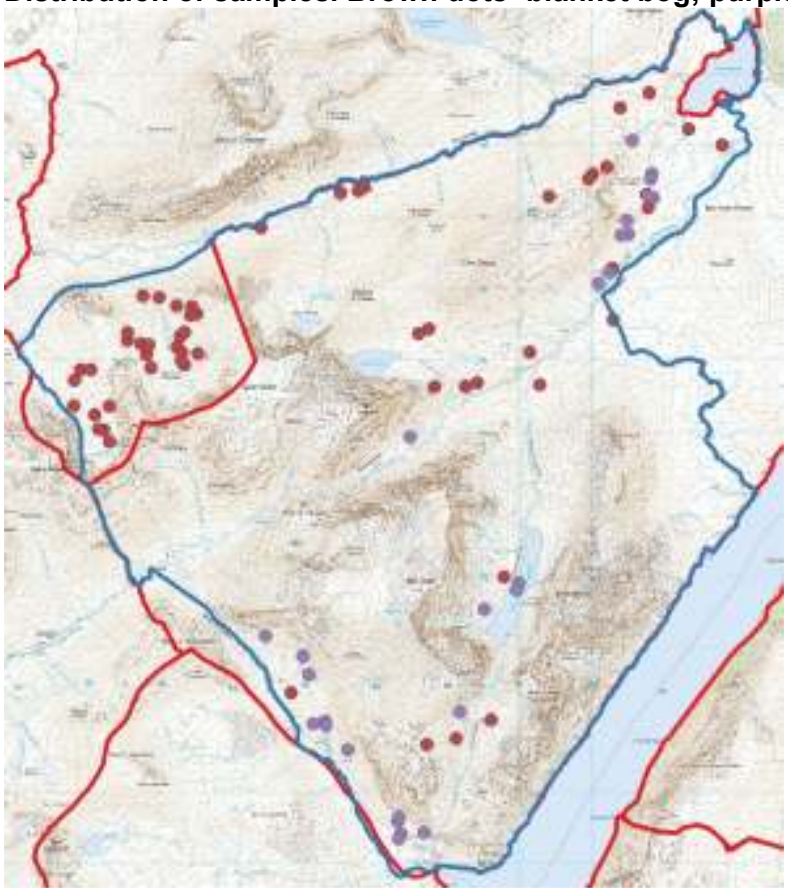


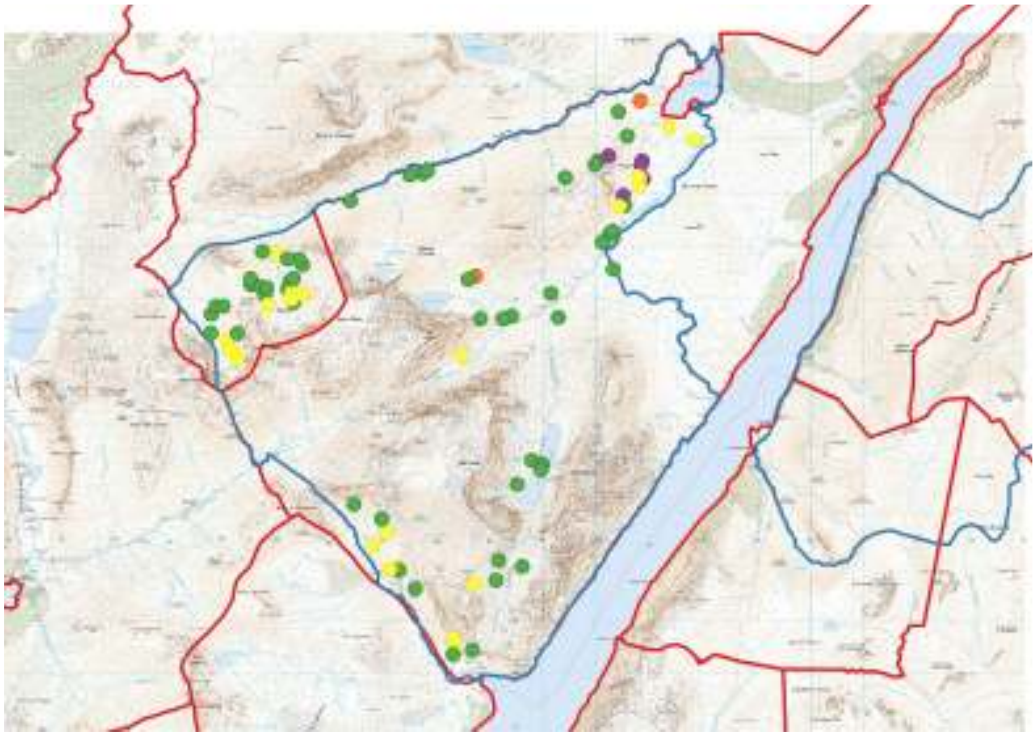
Chart 18



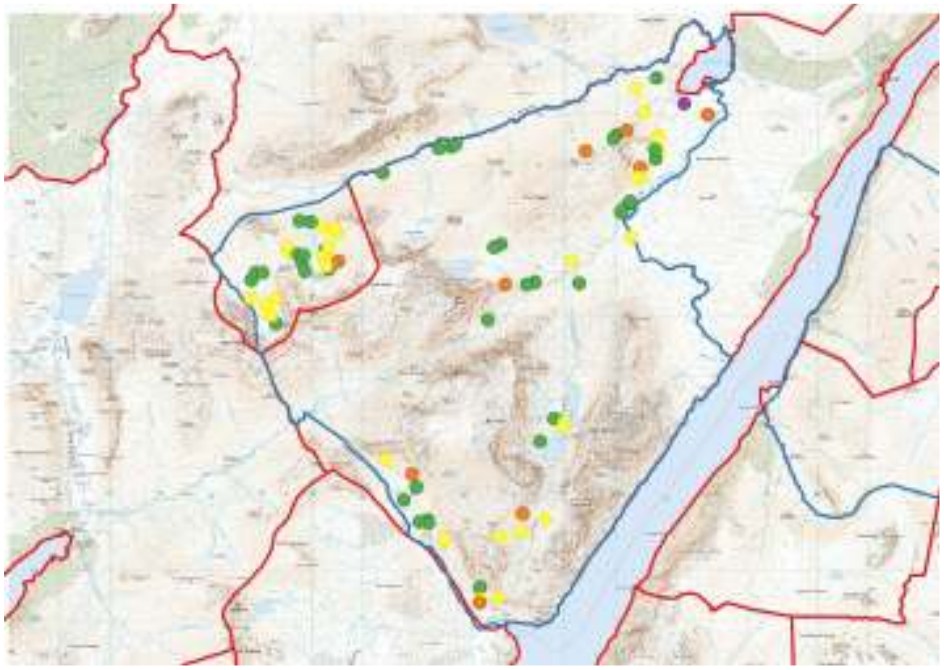
Map1
Distribution of samples. Brown dots- blanket bog; purple dots wet heath.



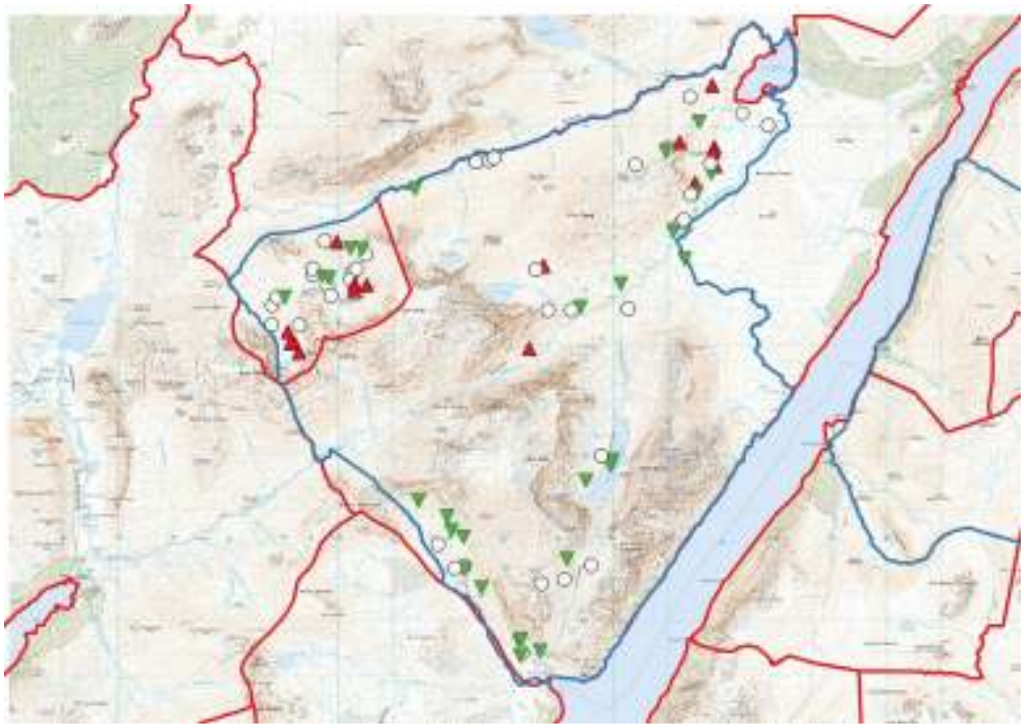
Map 2. Browsing impacts. Green dots – L; Yellow – ML; Orange – M; Purple - HM



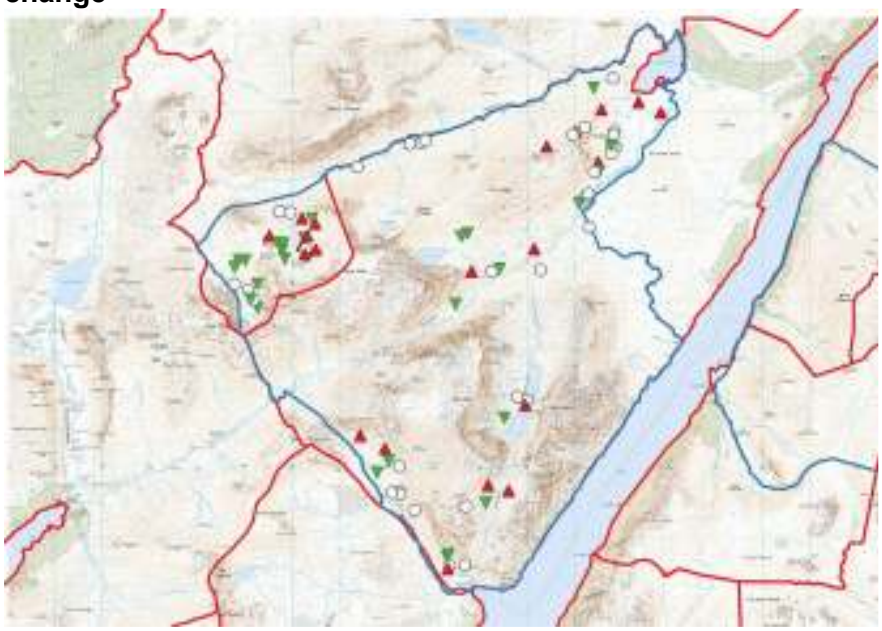
Map 3. Trampling impacts. Green dots – L; Yellow – ML; Orange – M; Purple - HM



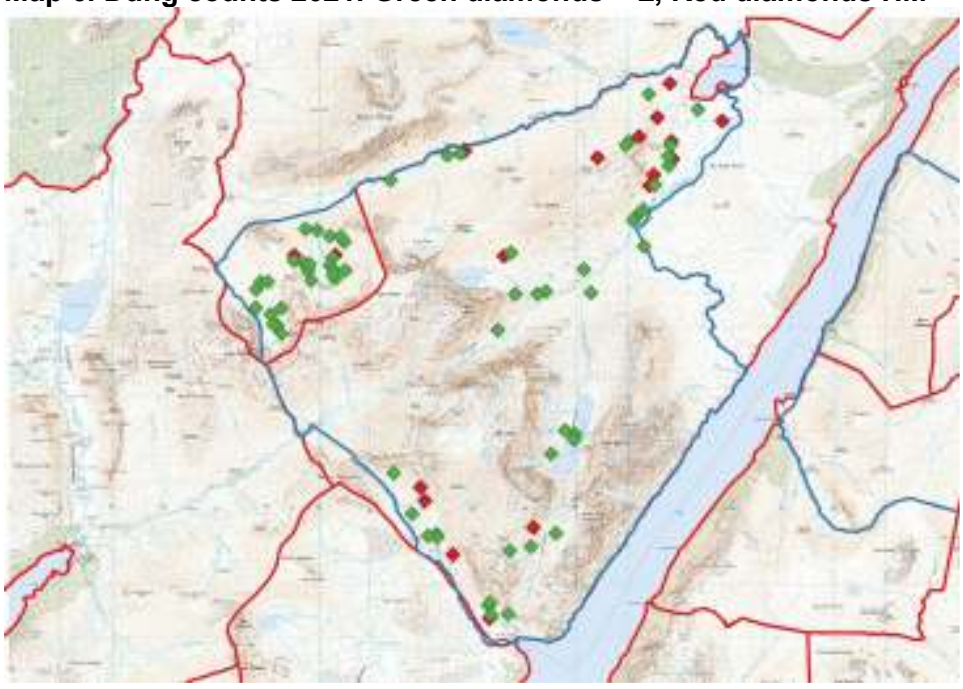
Map 4. Browsing impact change since 2013.
Green triangles – Decrease, Red triangles – Increase, White circles – No change



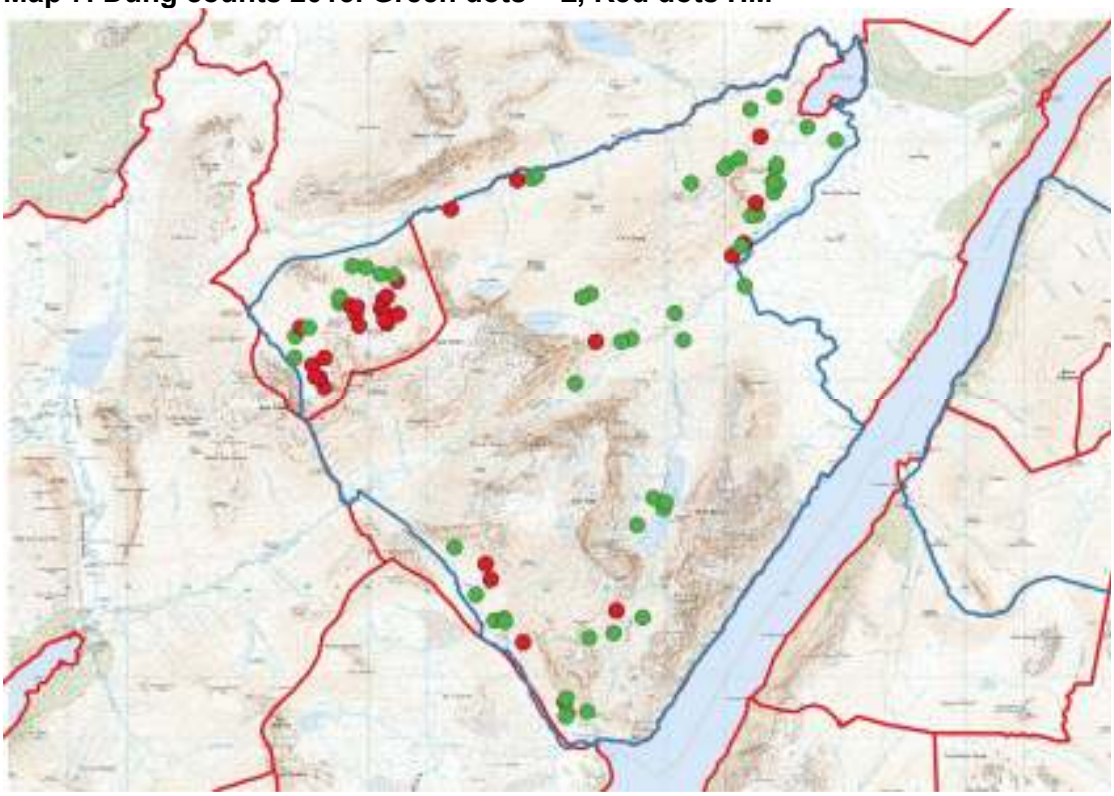
Map 5. Trampling impact change since 2013.
Green triangles – Decrease, Red triangles – Increase, White circles – No change



Map 6. Dung counts 2021. Green diamonds – L, Red diamonds HM



Map 7. Dung counts 2013. Green dots – L, Red dots HM



MODEL 1

MWDMG East Side model 2023-28

	Stags	Hinds	Calves	Total	Density
2021 Spring Population	1605	2472	650	4727	8.4
2021 Summer Population	1930	2797	780	5507	9.8
2021/22 Actual Cull	141	258	80	560	
2022 Mortality	39	56	47	141	
2022 Spring Population	1750	2483	653	4887	8.7
2022 Summer Population	2077	2810	759	5645	10.0
2022/23 Actual Cull	262	363	106	731	
2023 Mortality	42	56	46	143	
2023 Spring Population	1773	2390	607	4771	8.5
2023 Summer Population	2077	2694	862	5633	10.0
2023/24 Proposed Cull	246	390	130	766	
2024 Mortality	42	54	52	147	
2024 Spring Population	1789	2250	680	4720	8.4
2024 Summer Population	2130	2590	829	5549	9.8
2024/25 Proposed Cull	250	300	100	650	
2025 Mortality	43	52	50	144	
2025 Spring Population	1837	2239	679	4755	8.4
2025 Summer Population	2177	2578	825	5580	9.9
2025/26 Proposed Cull	250	330	110	690	
2026 Mortality	44	52	49	145	
2026 Spring Population	1883	2197	665	4745	8.4
2026 Summer Population	2216	2529	809	5554	9.8
2026/27 Proposed Cull	250	330	110	690	
2027 Mortality	44	51	49	143	
2027 Spring Population	1922	2149	651	4721	8.4
2027 Summer Population	2247	2474	792	5513	9.8
2027/28 Proposed Cull	250	300	100	650	
2028 Mortality	45	49	48	142	
2028 Spring Population	1952	2125	644	4721	8.4
2028 Summer Population	2274	2447	783	5504	9.8

MODEL 2

Ardverikie Model from 2021

	Stags	Hinds	Calves	Total	Density
2021 Spring Population	663	883	171	1717	*13.2*
2021 Summer Population	749	969	310	2027	*15.6*
2021-22 ACTUAL CULL	69	70	22	161	
Estimated emmigration	0	0	0	0	
2022 Mortality	15	19	19	53	
2022 Spring Population	665	879	269	1813	*14.0*
2022 Summer Population	799	1014	274	2087	*16.1*
2022-23 ACTUAL CULL	70	80	18	168	
Estimated emmigration	0	0	0	0	
2023 Mortality	16	20	16	53	
2023 Spring Population	713	914	239	1866	*14.4*
2023 Summer Population	833	1033	331	2197	*16.9*
2023-24 TARGET CULL	69	100	32	201	
Estimated emmigration	0	0	0	0	
2024 Mortality	17	21	20	57	
2024 Spring Population	747	913	279	1938	*14.9*
2024 Summer Population	887	1052	337	2275	*17.5*
2024-25 TARGET CULL	69	100	32	201	
Estimated emmigration	0	0	0	0	
2025 Mortality	18	21	20	59	
2025 Spring Population	800	931	284	2015	*15.5*
2025 Summer Population	942	1073	343	2358	*18.2*
2025-26 TARGET CULL	69	100	32	201	
Estimated emmigration	0	0	0	0	
2026 Mortality	19	21	21	61	
2026 Spring Population	854	952	291	2097	*16.1*
2026 Summer Population	1000	1097	351	2448	*18.8*
2026-27 TARGET CULL	69	100	32	201	
Estimated emmigration	0	0	0	0	
2027 Mortality	20	22	21	63	
2027 Spring Population	911	975	298	2184	*16.8*
2027 Summer Population	1060	1124	360	2543	*19.6*
2027- 28 TARGET CULL	69	100	32	201	
Estimated emmigration	0	0	0	0	
2028 Mortality	21	22	22	65	
2028 Spring Population	969	1002	306	2277	*17.5*

MODEL 3

Ardverikie Model from 2021 with estimated emmigration

	Stags	Hinds	Calves	Total	Density
2021 Spring Population	663	883	171	1717	*13.2*
2021 Summer Population	749	969	310	2027	*15.6*
2021-22 ACTUAL CULL	69	70	22	161	
Estimated emmigration	30	27	9	66	
2022 Mortality	15	19	19	53	
2022 Spring Population	635	852	260	1747	*13.4*
2022 Summer Population	765	982	265	2012	*15.5*
2022-23 ACTUAL CULL	70	80	18	168	
Estimated emmigration	30	27	9	66	
2023 Mortality	15	20	16	51	
2023 Spring Population	649	856	222	1727	*13.3*
2023 Summer Population	761	967	309	2037	*15.7*
2023-24 TARGET CULL	69	100	32	201	
Estimated emmigration	30	27	9	66	
2024 Mortality	15	19	19	53	
2024 Spring Population	646	820	250	1717	*13.2*
2024 Summer Population	771	945	303	2019	*15.5*
2024-25 TARGET CULL	69	90	30	189	
Estimated emmigration	30	27	9	66	
2025 Mortality	15	19	18	52	
2025 Spring Population	657	809	245	1712	*13.2*
2025 Summer Population	780	932	298	2010	*15.5*
2025-26 TARGET CULL	69	80	27	176	
Estimated emmigration	30	27	9	66	
2026 Mortality	16	19	18	52	
2026 Spring Population	665	807	244	1716	*13.2*
2026 Summer Population	787	929	297	2013	*15.5*
2026-27 TARGET CULL	69	80	27	176	
Estimated emmigration	30	27	9	66	
2027 Mortality	16	19	18	52	
2027 Spring Population	672	803	243	1719	*13.2*
2027 Summer Population	794	925	296	2015	*15.5*
2027- 28 TARGET CULL	69	80	27	176	
Estimated emmigration	30	27	9	66	
2028 Mortality	16	18	18	52	
2028 Spring Population	679	799	242	1721	*13.2*

MODEL 4

Reduce population to 10 deer per sq km by 2026, then 8 per sq km by 2028

	Stags	Hinds	Calves	Total	Density
2021 Spring Population	663	883	171	1717	*13.2*
2021 Summer Population	749	969	310	2027	*15.6*
2021-22 ACTUAL CULL	69	70	22	161	
Estimated emmigration	30	27	9	66	
2022 Mortality	15	19	19	53	
2022 Spring Population	635	852	260	1747	*13.4*
2022 Summer Population	765	982	265	2012	*15.5*
2022-23 ACTUAL CULL	70	80	18	168	
Estimated emmigration	30	27	9	66	
2023 Mortality	15	20	16	51	
2023 Spring Population	649	856	222	1727	*13.3*
2023 Summer Population	761	967	309	2037	*15.7*
2023-24 TARGET CULL	69	100	32	201	
Estimated emmigration	30	27	9	66	
2024 Mortality	15	19	19	53	
2024 Spring Population	646	820	250	1717	*13.2*
2024 Summer Population	771	945	303	2019	*15.5*
2024-25 TARGET CULL	110	200	65	375	
Estimated emmigration	30	27	9	66	
2025 Mortality	15	19	18	52	
2025 Spring Population	616	699	210	1526	*11.7*
2025 Summer Population	721	805	257	1783	*13.7*
2025-26 TARGET CULL	110	200	65	375	
Estimated emmigration	30	27	9	66	
2026 Mortality	14	16	15	46	
2026 Spring Population	567	562	168	1296	*10.0*
2026 Summer Population	651	646	207	1503	*11.6*
2026-27 TARGET CULL	90	100	32	222	
Estimated emmigration	30	27	9	66	
2027 Mortality	13	13	12	38	
2027 Spring Population	518	506	153	1176	*9.1*
2027 Summer Population	594	582	186	1363	*10.5*
2027- 28 TARGET CULL	90	100	32	222	
Estimated emmigration	30	27	9	66	
2028 Mortality	12	12	11	35	
2028 Spring Population	462	444	134	1040	*8.0*

MODEL 5

Reduce population to 6 deer per sq km by 2030, then 4 per sq km by 2032

	Stags	Hinds	Calves	Total	Density
2028 Spring Population	462	444	134	1040	*8.0*
2028 Summer Population	529	511	179	1219	*9.4*
2028-29 TARGET CULL	80	120	40	240	
Estimated emmigration	30	0	0	30	
2029 Mortality	11	10	11	32	
2029 Spring Population	408	381	128	917	*7.1*
2029 Summer Population	472	445	156	1073	*8.3*
2029-30 TARGET CULL	80	120	40	240	
Estimated emmigration	30	0	0	30	
2030 Mortality	9	9	9	28	
2030 Spring Population	353	316	106	775	*6.0*
2030 Summer Population	406	369	129	905	*7.0*
2030-31 TARGET CULL	80	100	35	215	
Estimated emmigration	15	0	0	15	
2031 Mortality	8	7	8	23	
2031 Spring Population	303	262	86	651	*5.0*
2031 Summer Population	346	305	107	758	*5.8*
2031-32 TARGET CULL	80	90	30	200	
Estimated emmigration	15	0	0	15	
2032 Mortality	7	6	6	19	
2032 Spring Population	244	209	70	524	*4.0*

MODEL 6

Sustainable cull @ 10 deer per sq km

	Stags	Hinds	Calves	Total	Density
Y1 Spring Population	565	565	165	1295	*10.0*
Y1 Summer Population	648	648	207	1502	*11.6*
Y1 TARGET CULL	70	70	22	162	
Estimated emmigration	0	0	0	0	
Y1 Mortality	13	13	12	38	
Y2 Spring Population	565	565	173	1302	*10.0*
Y2 Summer Population	651	651	208	1510	*11.6*
Y2 TARGET CULL	70	75	25	170	
Estimated emmigration	0	0	0	0	
Y2 Mortality	13	13	12	39	
Y3 Spring Population	568	563	171	1302	*10.0*
Y3 Summer Population	653	648	207	1509	*11.6*
Y3 TARGET CULL	70	75	25	170	
Estimated emmigration	0	0	0	0	
Y3 Mortality	13	13	12	38	
Y4 Spring Population	570	560	170	1301	*10.0*
Y4 Summer Population	655	645	207	1507	*11.6*
Y4 TARGET CULL	70	75	25	170	
Estimated emmigration	0	0	0	0	
Y4 Mortality	13	13	12	38	
Y5 Spring Population	572	557	169	1299	*10.0*
Y5 Summer Population	657	642	205	1504	*11.6*
Y5 TARGET CULL	70	75	25	170	
Estimated emmigration	0	0	0	0	
Y5 Mortality	13	13	12	38	
Y6 Spring Population	574	554	168	1296	*10.0*

MODEL 7

Sustainable cull @ 8 deer per sq km

	Stags	Hinds	Calves	Total	Density
Y1 Spring Population	445	445	150	1040	*8.0*
Y1 Summer Population	520	520	182	1222	*9.4*
Y1 TARGET CULL	60	70	25	155	
Estimated emmigration	0	0	0	0	
Y1 Mortality	10	10	11	32	
Y2 Spring Population	450	440	146	1035	*8.0*
Y2 Summer Population	523	513	179	1215	*9.4*
Y2 TARGET CULL	60	65	20	145	
Estimated emmigration	0	0	0	0	
Y2 Mortality	10	10	11	31	
Y3 Spring Population	452	437	149	1038	*8.0*
Y3 Summer Population	527	512	179	1217	*9.4*
Y3 TARGET CULL	60	65	20	145	
Estimated emmigration	0	0	0	0	
Y3 Mortality	11	10	11	32	
Y4 Spring Population	456	436	148	1041	*8.0*
Y4 Summer Population	530	511	179	1220	*9.4*
Y4 TARGET CULL	60	65	20	145	
Estimated emmigration	0	0	0	0	
Y4 Mortality	11	10	11	32	
Y5 Spring Population	460	435	148	1043	*8.0*
Y5 Summer Population	534	509	178	1221	*9.4*
Y5 TARGET CULL	60	65	20	145	
Estimated emmigration	0	0	0	0	
Y5 Mortality	11	10	11	32	
Y6 Spring Population	463	434	148	1045	*8.0*

MODEL 8

Sustainable cull @ 6 deer per sq km

	Stags	Hinds	Calves	Total	Density
Y1 Spring Population	335	335	110	780	*6.0*
Y1 Summer Population	390	390	148	928	*7.1*
Y1 TARGET CULL	50	53	20	123	
Estimated emmigration	0	0	0	0	
Y1 Mortality	8	8	9	24	
Y2 Spring Population	332	329	119	781	*6.0*
Y2 Summer Population	392	389	148	928	*7.1*
Y2 TARGET CULL	50	53	20	123	
Estimated emmigration	0	0	0	0	
Y2 Mortality	8	8	9	24	
Y3 Spring Population	334	328	119	781	*6.0*
Y3 Summer Population	393	388	147	928	*7.1*
Y3 TARGET CULL	50	53	20	123	
Estimated emmigration	0	0	0	0	
Y3 Mortality	8	8	9	24	
Y4 Spring Population	336	327	118	781	*6.0*
Y4 Summer Population	395	386	147	927	*7.1*
Y4 TARGET CULL	50	53	20	123	
Estimated emmigration	0	0	0	0	
Y4 Mortality	8	8	9	24	
Y5 Spring Population	337	325	118	780	*6.0*
Y5 Summer Population	396	384	146	926	*7.1*
Y5 TARGET CULL	50	53	20	123	
Estimated emmigration	0	0	0	0	
Y5 Mortality	8	8	9	24	
Y6 Spring Population	338	324	117	779	*6.0*

MODEL 9

Sustainable cull @ 4 deer per sq km

	Stags	Hinds	Calves	Total	Density
Y1 Spring Population	218	218	88	524	*4.0*
Y1 Summer Population	262	262	105	629	*4.8*
Y1 TARGET CULL	37	37	15	89	
Estimated emmigration	0	0	0	0	
Y1 Mortality	5	5	6	17	
Y2 Spring Population	220	220	84	523	*4.0*
Y2 Summer Population	262	262	105	628	*4.8*
Y2 TARGET CULL	37	37	15	89	
Estimated emmigration	0	0	0	0	
Y2 Mortality	5	5	6	17	
Y3 Spring Population	219	219	83	522	*4.0*
Y3 Summer Population	261	261	104	626	*4.8*
Y3 TARGET CULL	37	37	15	89	
Estimated emmigration	0	0	0	0	
Y3 Mortality	5	5	6	17	
Y4 Spring Population	219	219	83	521	*4.0*
Y4 Summer Population	260	260	104	625	*4.8*
Y4 TARGET CULL	37	37	15	89	
Estimated emmigration	0	0	0	0	
Y4 Mortality	5	5	6	17	
Y5 Spring Population	218	218	83	519	*4.0*
Y5 Summer Population	260	260	104	623	*4.8*
Y5 TARGET CULL	37	37	15	15	
Estimated emmigration	0	0	0	0	
Y5 Mortality	5	5	6	17	
Y6 Spring Population	217	217	83	517	*4.0*

MODEL 10: Ardverikie Woodland Model

Reduce population to 10 deer per sq km

Year 0 is provisionally 2024-25

by Year 0+1, then 8 per sq km by Year 0+3

	Stags	Hinds	Calves	Total	Density	
2021 Spring Population	663	883	171	1717	*13.2*	
2021 Summer Population	749	969	310	2027	*15.6*	
2021-22 ACTUAL CULL	69	70	22	161		
Estimated emmigration	30	27	9	66		
2022 Mortality	15	19	19	53		
2022 Spring Population	635	852	260	1747	*13.4*	
2022 Summer Population	765	982	265	2012	*15.5*	
2022-23 ACTUAL CULL	70	80	18	168		
Estimated emmigration	30	27	9	66		
2023 Mortality	15	20	16	51		
2023 Spring Population	649	856	222	1727	*13.3*	
2023 Summer Population	761	967	309	2037	*15.7*	
2023-24 TARGET CULL	69	100	32	201		
Estimated emmigration	30	27	9	66		
2024 Mortality	15	19	19	53		
2024 Spring Population	646	820	250	1717	*13.2*	
2024 Summer Population	771	945	303	2019	*15.5*	
2024-25 TARGET CULL	110	200	65	375		Assume starting reduction cull at this point.
Estimated emmigration	30	27	9	66		
2025 Mortality	15	19	18	52		
2025 Spring Population	616	699	210	1526	*12.8*	Deer range reduced by 1000 ha
2025 Summer Population	721	805	257	1783	*15.0*	Reduction may be deferred depending on timing of consent.
2025-26 TARGET CULL	140	210	70	420		
Estimated emmigration	30	27	9	66		
2026 Mortality	14	16	15	46		
2026 Spring Population	537	552	163	1251	*10.5*	

2026 Summer Population	618	633	203	1454	*12.2*
2026-27 TARGET CULL	65	150	50	265	
Estimated emmigration	30	27	9	66	
2027 Mortality	12	13	12	37	
2027 Spring Population	511	443	131	1086	*9.1*
2027 Summer Population	576	509	163	1249	*10.5*
2027- 28 TARGET CULL	65	100	32	197	
Estimated emmigration	30	27	9	66	
2028 Mortality	12	10	10	31	
2028 Spring Population	470	372	112	954	*8.0*

Appendix 8.6.3 Deer Population Model

EIA APPENDIX 8.6: Outline Biodiversity Enhancement and Management Plan

Earba Pumped Storage Hydro Scheme

Earba Limited

SLR Project No.: 428.013028.00001

28 February 2024

MODEL 9

Reduce population to 10 deer per sq km

Year 0 is provisionally 2024-25

by Year 0+1, then 8
per sq km by Year 0+3

	Stags	Hinds	Calves	Total	Density	
2021 Spring Population	663	883	171	1717	*13.2*	
2021 Summer Population	749	969	310	2027	*15.6*	
2021-22 ACTUAL CULL	69	70	22	161		
Estimated emmigration	30	27	9	66		
2022 Mortality	15	19	19	53		
2022 Spring Population	635	852	260	1747	*13.4*	
2022 Summer Population	765	982	265	2012	*15.5*	
2022-23 ACTUAL CULL	70	80	18	168		
Estimated emmigration	30	27	9	66		
2023 Mortality	15	20	16	51		
2023 Spring Population	649	856	222	1727	*13.3*	
2023 Summer Population	761	967	309	2037	*15.7*	
2023-24 TARGET CULL	69	100	32	201		
Estimated emmigration	30	27	9	66		
2024 Mortality	15	19	19	53		
2024 Spring Population	646	820	250	1717	*13.2*	
2024 Summer Population	771	945	303	2019	*15.5*	
2024-25 TARGET CULL	110	200	65	375		Assume starting reduction cull at this point.
Estimated emmigration	30	27	9	66		
2025 Mortality	15	19	18	52		
2025 Spring Population	616	699	210	1526	*12.8*	Deer range reduced by 1000 ha
2025 Summer Population	721	805	257	1783	*15.0*	Reduction may be deferred depending on timing of consent.
2025-26 TARGET CULL	140	210	70	420		
Estimated emmigration	30	27	9	66		
2026 Mortality	14	16	15	46		
2026 Spring Population	537	552	163	1251	*10.5*	
2026 Summer Population	618	633	203	1454	*12.2*	
2026-27 TARGET CULL	65	150	50	265		
Estimated emmigration	30	27	9	66		
2027 Mortality	12	13	12	37		
2027 Spring Population	511	443	131	1086	*9.1*	
2027 Summer Population	576	509	163	1249	*10.5*	
2027- 28 TARGET CULL	65	100	32	197		
Estimated emmigration	30	27	9	66		
2028 Mortality	12	10	10	31		
2028 Spring Population	470	372	112	954	*8.0*	

Appendix 8.6.4 Overview on Peatland Survey (Angus Davidson Ltd)

EIA APPENDIX 8.6: Outline Biodiversity Enhancement and Management Plan

Earba Pumped Storage Hydro Scheme

Earba Limited

SLR Project No.: 428.013028.00001

28 February 2024

Ardverikie Estate

OVERVIEW ON PEATLAND SURVEY

ADL | 2023 | 07795457450

OVERVIEW

The purpose of this review has been to identify both the hydrological catchments within the bounds of Ardverikie, and to propose a program of works that takes into account a range of factors (to be outlined).

AREAS SUITABLE FOR RESTORATION

The most recent piece of work focused on areas classed as: -

- **Primary restoration zones**
- **Secondary restoration zones**
- **Tertiary restoration zones**

The intention as part of this proposal is to follow an agreed pathway based on the above approach and as noted in the deer management plan. At the point of delivery of any peatland restoration project, all stakeholders will have been consulted and then informed of the project timelines.

As an example of project delivery, it would include elements that take into account: -

- Time of year (Snow, heavy rain, bird nesting all can impact delivery)
- Current deer movements / hefts
- Future deer movements / Hefts in response to active management strategy
- General condition of site (regardless of restoration zone type)
- Restoration work would be informed by an appropriate Habitat Impact Assessment such as is carried out on a designated site using *MacDonald et al 1998*.

The amount of work required to restore a site would be underpinned not just by all of the above, as well as a discussion with the estate on any nuanced changes in deer movements as a result of changes in management.

In addition, the size of any site is often dictated by the work required to restore it, time of year, availability of contractors and the need to act in a way that ensures the restored site has the best chance of regeneration.

There are also numerous steps to deliver a peatland project such as: -

- Highland council require peatland sites to have planning permission
- Scottish water will potentially have some of the site in a drinking water catchment and will set out statutory guidance measures
- Peat slide risk assessment
- Construction, Environmental Management Plan (CEMP) required.
- SEPA do NOT need to be informed as long as statutory guidance is followed around watercourses.

Area's A / B / C - (All of above Shown in attached map)

Whilst ADL propose restoration is undertaken in the order above, it should be noted that any site considered for restoration will still undergo an appropriate habitat assessment as noted above. This will ensure that the restoration undertaken will be on a site that is optimal condition and has the best possible outcomes forecasted.

Note that drone footage is also used to define herbivore impacts and look at any potential mitigation measures.

Current and future deer management is likely to evolve over time and will also have a similar effect on habitats. While current deer numbers and the proposed management plan are evidenced by Mr Victor Clements elsewhere, the working plan is also likely to change in response to information such as deer numbers, areas of hefting and habitat responses.

It is advised that the timeframes to complete agreed restoration should not be fixed or given unachievable deadlines in order to meet specific targets. Rather restoration outcomes should be predicated on good information and carried out by competent and experienced contractors to the highest standards.

The expectation is however that restoration would be carried out in a timeframe of no longer than five years.

This will encourage appropriate decision making by all stakeholders and ensure that the goals as set out in the planning application can be met within the timelines of the project.

HABITAT TYPES AND RESTORATION PRACTICE

The scale of the work required on Ardverikie is significant and a planned approach agreed by all stakeholders is essential. While it is noted that peatland restoration is part of the planning condition for the pump storage scheme as previously noted, the primary concern should be the delivery of a high quality restoration program underpinned by the best information available. This may well lead to a slower start than planned, with work ramped up towards the end of the project.

The habitats are such that ADL would likely advise that areas of no more than 150ha be undertaken as part of each project. This ensures that projects are not subject to long completion timelines due to weather or other externalities.

The sites noted as A – B are likely to require significant restoration due to the depth of the degradation and the habitats that surround them. This can make even small projects

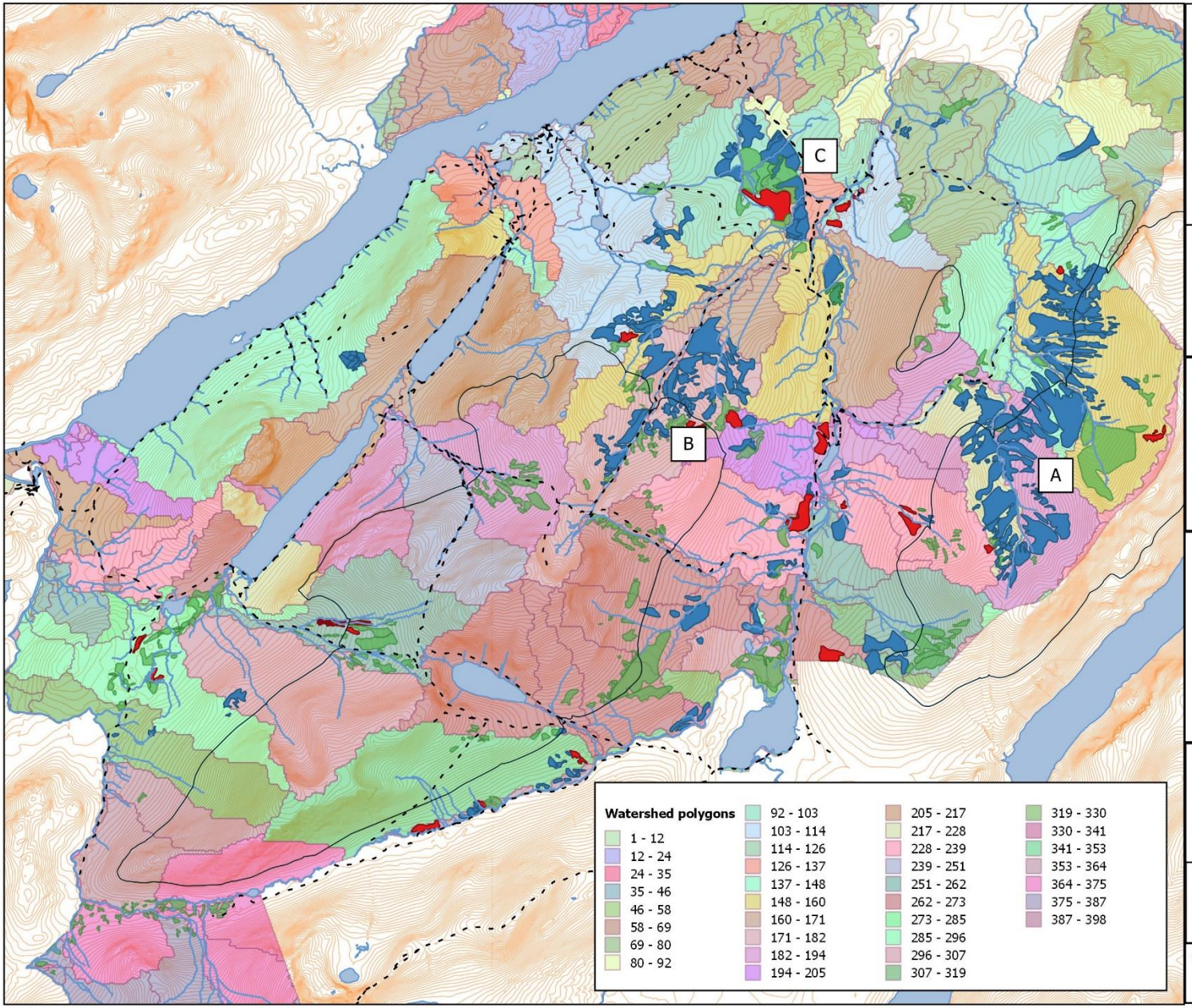
over 150ha run for up to three to four months depending on the amount of contractor time allocated.

There are also current challenges that peatland action have found in attracting experienced contractors to undertake restoration, so engagement of appropriate contractors should be undertaken as early in the design phase as possible.

Overall however, the sites noted above have in general been shown to have the best potential for restoration in the short to medium terms.

NEXT STEPS

Given the short timeframes to respond to the question of restoration and where it should occur, it is advised that any future works be undertaken in light of the best available information in advance of any proposed work.



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Ardverikie estate
Catchment map

Area A - Around 829ha supported by restoration with 516ha above 600m

Area B - Around 427ha supported by restoration, with 120ha above 600m

Area C - Around 181ha supported by restoration.

Ardverikie
600m polygon
Lochs / Rivers
Primary
Secondary
Tertiary
Watercourses
track

N
W
E
S

Map reference: NN523548412
Produced on: 12/02/2024
Created by: C Morrison

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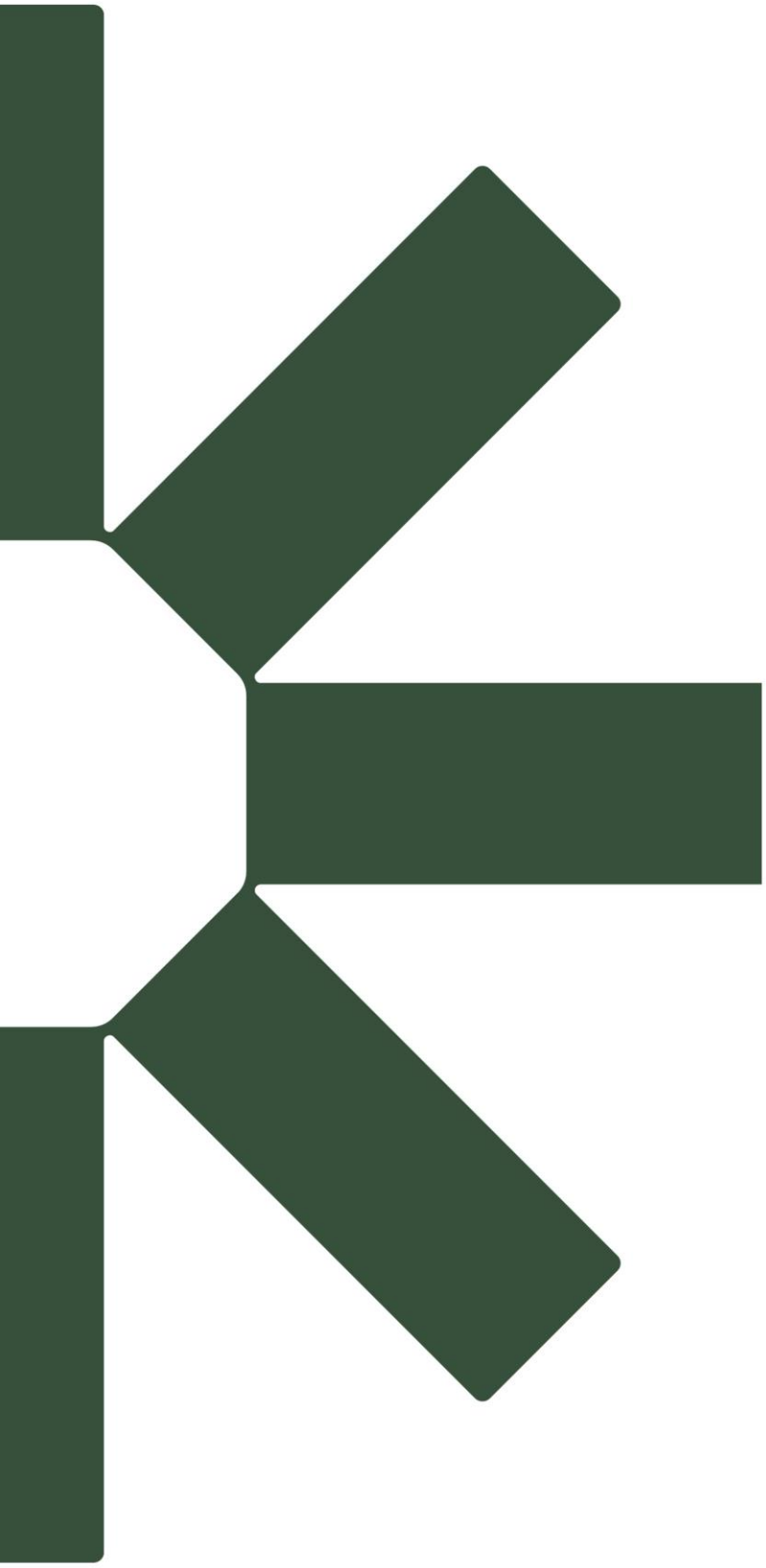
References

MacDonald, A. Stevens, P. Armstrong, H. Immirzi, P. Reynolds, P. (1998) A guide to upland habitats surveying land management impacts ISBN 1 85 397 296 7



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