



Forestry and
Land Scotland
Coilltearachd agus
Fearann Alba

Loch Katrine

Land Management Plan 2023-2033 Central Region

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We manage Scotland's national forests and land to the United Kingdom Woodland Assurance Standard – the standard endorsed in the UK by the international Forest Stewardship Council® and the Programme for the Endorsement of Forest Certification. We are independently audited.

Our land management plans bring together key information, enable us to evaluate options and plan responsibly for the future. We welcome comments on these plans at any time.



The mark of
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Loch Katrine LMP

1 Objectives and Summary

1.1 Plan overview and objectives

Plan name	Loch Katrine Land Management plan
Included area	Loch Katrine & Loch Arklet (Reference: M2 Zone reference map)
Size of plan area (ha)	9,598 ha
Location	See location map (M1)

Long Term Vision

To protect the existing native woodland and encourage its expansion into the higher elevations, linking woodland from the Loch shore up into the hills. This development and recovery of habitats will take time, and can only be achieved through a strategic and long term management of the herbivore impacts, promoting a healthy and sustainable population of deer throughout the wider landscape.

The Loch Katrine reservoir forms a strategic water supply for Central Scotland, and in a changing climate future resilience within the catchment will be key to buffering and protecting the Loch, especially from extreme events such as landslides. Capture of carbon in both woodland creation and peatland restoration, achieved through woodland creation and a rewetting of peatland areas, will help to restore a functioning ecosystem which will contribute towards government targets and follow current policies.

Wherever possible, natural processes of succession will be encouraged to develop within the catchment, playing out over long time periods to enable the evolution of a long term dynamic ecosystem which can adapt to changes in the climate well into the future. As well as improving the biodiversity of both flora and fauna within the Great Trossachs Forest National Nature Reserve (NNR).



Long Term Vision

Tourism and recreation are also on the increase and both woodland creation and a variety of open habitats will make a positive contribution to the wider local landscape.

This Land Management Plan (LMP), is situated in the heart of Loch Lomond and Trossachs National Park (LLTNP), which was the first national park formed within Scotland, **Reference: M1 Location and Context**. The catchment forms part of a strategic water supply managed by Scottish Water, which supplies much of the central belt of Scotland. Scottish Water are the current landowners of the catchment which includes Loch Katrine and Loch Arklet. In 2005 Scottish Water commissioned a long term lease to Forestry and Land Scotland (then Forestry Commission Scotland) for a period of 150 years.

This LMP will be the first revision of the original Forest Design plan (FDP), which was approved in 2008, as undertaken by Forest Enterprise Scotland (FES) at the time, now Forestry and Land Scotland (FLS).

1.2 Main Considerations

Consideration	Description
#1: Water quality	<p>Loch Katrine & Loch Arklet form a Strategic water supply for the Central belt in Scotland.</p> <p>Recent landslides in 2019 severely impacted on the water quality, through sedimentation of the Loch and erosion of watercourses. This impacted heavily on the reservoir infrastructure and tunnels.</p> <p>This sedimentation highlighted the increasing erosion of watercourses throughout the catchment, as well as a lack of long term resilience in vegetation cover and soil protection (provided via tree canopy protection), along much of the riparian systems throughout the catchment network.</p> <p>Riparian planting will help stabilize the watercourse banks, as well as rock slope failure (RSF) prone locations, to create a natural buffer and mitigate against erosion during peak flows periods or sudden heavy rain events; predicted in a future changing climate</p>
#2: Herbivore impacts	<p>Herbivores present a challenging constraint for successful long term management within the catchment, preventing recovery of degraded habitats and natural regeneration of vegetation and trees.</p> <p>Seek to work with neighbouring landowners and Deer Management Groups (DMG) to achieve and encourage wider landscape objectives, to contribute to government aims/targets for woodland creation and peatland restoration.</p>



Consideration	Description
#3: Access	<p>Some areas of the catchment are either inaccessible or proving to be more challenging to reach safely for the undertaking of management activities.</p> <p>Access in these areas are required to:-</p> <ul style="list-style-type: none"> • Aid recovery of habitats in the upland zones. • Facilitate the undertaking of PAW'S restoration, through harvesting and restock operations • long-term wildlife control. <p>Construction or an upgrading of quad routes, with benching at key points will facilitate the long term access and management of the catchment.</p>
#4: Climate change (Carbon):	<p>Government targets to reach net zero by 2040, a target set at COP 26 Climate change summit. Carbon capture in woodland creation and peatland restoration within the catchment, will contribute towards government targets.</p> <p>Carbon capture will offset the carbon usage by Scottish Water in their day to day business.</p>
#5: Disease and non-native species	<p>The treat from the <u><i>Phytophthora ramorum</i></u> disease will impact the management of the non-native conifers located within the catchment. All larch will be felled to help prevent the spread of this disease.</p> <p>Plantations on Ancient Woodland Sites (PAWS), which consist of coniferous blocks, mainly Sitka spruce and larch, are located in isolated and hard to reach locations. An undertaking to remove the coniferous stands will be challenging with regards to the logistics, i.e. getting required machinery into blocks and movement of timber from site to the market. Water quality and other forest users and residents are key considerations when planning this operation.</p>
#6: Visitors/Business & residents:	<p>Tourism plays a large part in the local economy and Loch Katrine is a destination site. Businesses have built up around the Loch and include self-catering accommodation, chalets, cycle hire, guided walks and boat trips. Consideration to these businesses as well as local residents is paramount when designing and delivery the vision. Iconic viewpoints will be maintained.</p>

Table 1: Loch Katrine LMP zoning

1.3 Future forest design



Key challenges associated with this site and the LMP Objectives as detailed in the LMP Brief ([Appendix II](#)) and below, revolve around the deer management and legacy of previous land use.

These include:

- Management of herbivore impact to promote the natural regeneration of trees and to successional processes to develop over longer time periods within the catchment.
- Accessing peatland and woodland creation areas long term to maintain habitats
- Restoring peatland habitats through a rewetting and re-profile exposed hags areas to revegetate by maintaining control of herbivore .
- Removal of larch and non-native coniferous plantations, through the implementation of the PAWS policy.
- Managing operations in a busy tourist location
- Appropriate species selection with consideration given to degraded soils including compromised soil functionality and localised variability.



2 Introduction

2.1 The existing land holding

See **Appendix I: Supporting Information Sections 1.0 & 3.0.**

Reference the Forest Design Plan 2007 (Scottish Forestry File Ref: 033/CT/L/08 (15)), as well as the **Integrated Catch Management Plan (ICMP) 2002 Appendix VI**, for further information.

Land Use	Area (Ha)
Forest	2,621
Open Land	6,917
Open water (Lochans, roads etc)	60
Total	9,598

Table 2: Loch Katrine LMP zoning

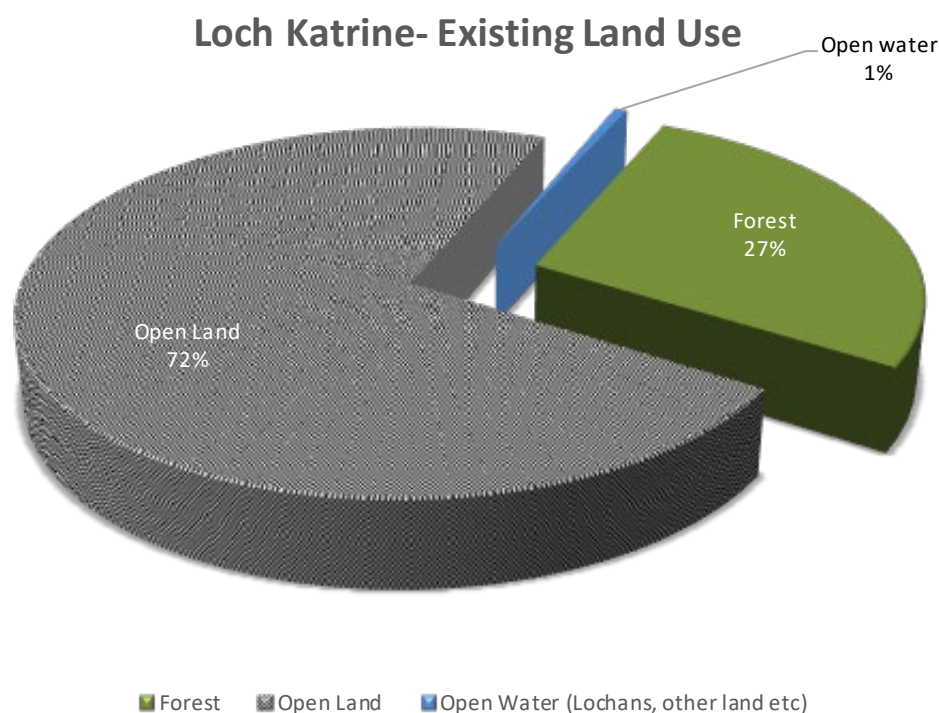


Figure 1: Broad land use breakdown by area (hectare) and percentage cover at Loch Katrine. Starting point of LMP planning revise (Year 0, 2024)



Loch Katrine-Breakdown of existing Land Use

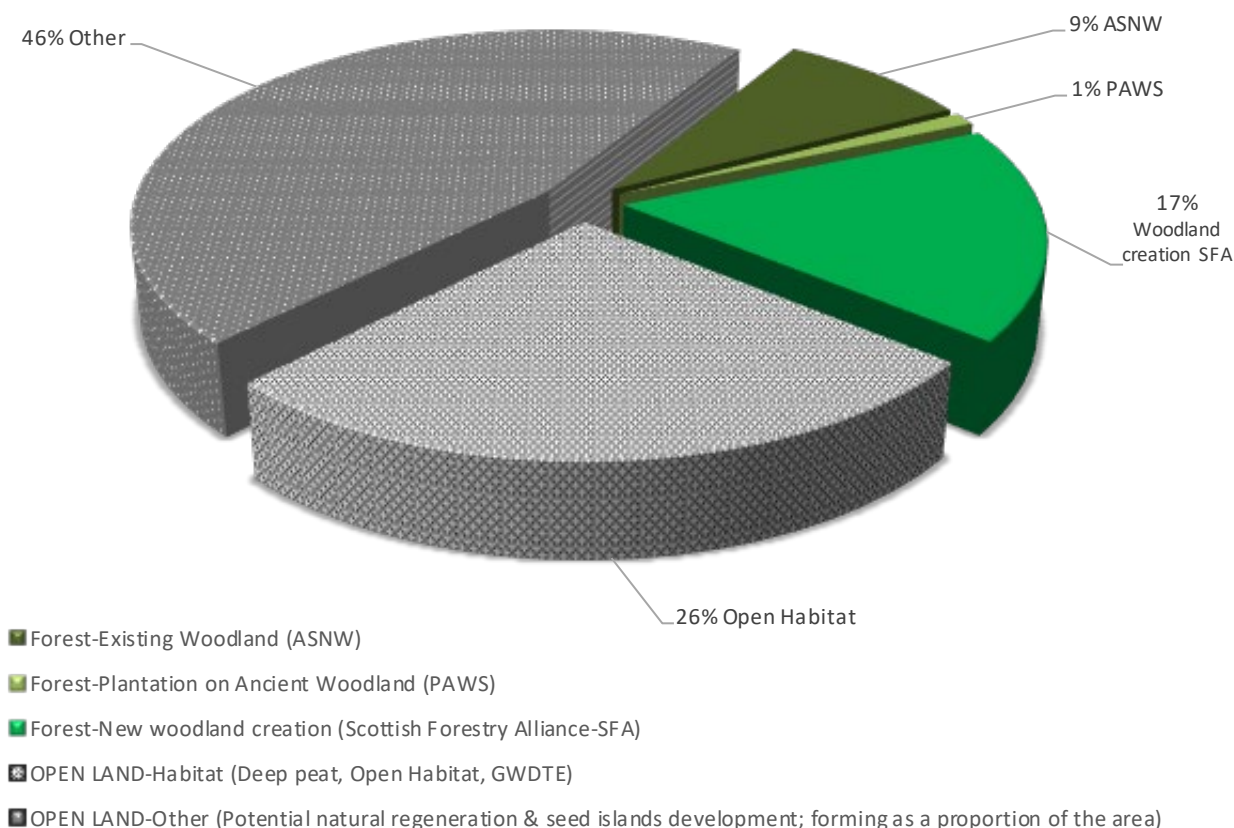


Figure 2: Breakdown of exiting Land-use, providing further detail to Figure 1, shown previously.

As illustrated in the pie chart, Figure #1, the current land use exists largely as an open space, accounting for 76% of the land. Existing woodland, PAWS and new woodland creation, undertaken in 2007 through the SFA project, accounts for 27% which has been referenced as 'Forest'. Open water and roads have been referenced as 'Other' and account for 1%.

The pie chart above, in Figure 2, expands on the broad categories noted as 'Forest' and 'Open land', found in Figure #1. The 'Forest' category has been expanded further to show the proportion of forest accounting as Ancient Woodland (ASNW), conifer plantations forming the Plantation on Ancient Woodland Sites (PAWS) and the SFA Woodand creation (2007). The 'Open land' category has also been further expanded, to show areas of open land that will remain as open space, forming habitats such as Priority Open Habitat (POH) and or peatland (deep peat) areas.

The 'Open Land' category, in Figure #1, has been further subdivided into the 'Other' category in Figure #2, accounts for areas of the catchment which currently exist as mainly acid grassland. These areas have the potential for further woodland expansion, through natural regeneration, riparian planting or other.



2.2 Setting and context

Reference: M1. Location and Context map

Consistent with the two Landscape Character Types as detailed in the LVRDR report **Reference: Appendix VI LVRDR & Appendix VII**, the local landscape features at Loch Katrine represent a transition between broad, open upland along the southern boundary, to rolling moorland plateau beyond the northern boundary of the site. Land use in the local landscape is largely open rough grazing, upland plantation woodland and open habitat.

As illustrated in the Concept map **Reference: 'Initial Analysis & Concept' map – M3**, Loch Katrine's boundary is joined in the east with the Glen Finglas Estate, managed by the Woodland Trust. In the west it directly abuts Inversaid estate, managed by the Royal Society for the Protection of Birds (RSPB). In 2007 both estates were involved in a partnership to the former woodland creation project, which was commissioned in 2007 as part of the Scottish Forestry Alliance (SFA) partnership and Heritage Lottery fund (HLF) scheme. This involved the creation of new native wood as part of the 'Great Trossachs Forest NNR', which falls within a part of the temperate rainforest zone. To the west of the catchment a private estate, Comer Estate, follows along Loch Lomond shore and also neighbours to the Forestry and Land Scotland's Estate, which has two notable forest blocks, Ptarmigan and Loch Ard forest. To the north, there are numerous private estates (such as Inverlochlarig, Baircreich, Muirlaggan, Ballimore and Glenfalloch), which manage land for a range of objectives such as sporting, forestry, sheep grazing and other.

Loch Katrine lies at the heart of what is Scotland's first National Park. This landscape has played a significant role in the history as well as in the literature of Scotland, with its 'landscape of Lochs and Hills'. Early writers such as Wordsworth, Coleridge and Sir Walter Scott helped make Loch Katrine famous and it was also the inspiration for Scott's 'The Lady of the Lake', which attracted 18th century tourists to visit the Trossachs area. Both of the MacGregor clan graveyards are located on Loch Katrine, one at Portnellan and the other at the north of the Loch by Glen Gyle. Rob Roy MacGregor was born at Glen Gyle house in 1671. At that time this area was a much more populated place with the Glen providing one of the main drove routes for cattle from Loch Lomond and the west. This historical connection with cattle in the landscape, is reflected by remnant woodland pasture which can be found in Glen Gyle.

The catchment area is made up of Loch Katrine and Loch Arklet, which function primarily as reservoirs and have been raised three times changing the extent and volume of water in both Lochs. These reservoirs function as part of a strategic water supply managed by Scottish Water, which supplies much of the central belt of Scotland. Scottish Water are the current landowners of the catchment. In 2005 Scottish Water agreed a long term lease to Forestry and Land Scotland (then Forest Enterprise Scotland) for a period of 150 years.



2.3 LMP presentation

Due to the scale of this Land Management Plan, the area has been divided into **seven zones**. These zones have been identified through common attributes and similar management objectives. The use of zones will make understanding how the plan objectives are relevant to individual area, allowing for more appropriate concepts and proposals for each location.

Zone	Location	Common Attributes
1	Arklet North	Generally south to south-west facing slope. Open character with views towards Loch Arklet and Loch Lomond. New planting from previous plan on lower slopes. Some land slips. Some residential properties adjacent to loch shore road. Stronachlacher Pier visitor hub is within this area and includes a number of holiday homes as well as the Pier café and car park which are out with the LMP area. Upper slopes have a sense of remoteness.
2	Glen Gyle	Enclosed valley extending north-west from Loch Katrine. Crossed by the overhead electricity pylons which are a dominant feature in this area. New planting is present in this area, together with remnant wood pasture. Extensive land slips have occurred on the northern slopes and hard engineering works to stabilise these have been undertaken over the past year or so. Few residential properties. Upper slopes and westernmost end have a sense of remoteness. There is remnant conifer plantation around the property of Glen Gyle.
3	Katrine North	While there is new planting on the lower slopes of this area, it generally has a more open hillside character with views either east or west along the loch. There is evidence of some land slips here, but less severe than those in Glen Gyle. There are two properties within this zone. There is remnant conifer plantation in the vicinity of Schoolhouse.
4	Edra and Letter	Edra and Letter is similar to Katrine North in character, although has a sense of a valley landscape influenced by the Strone and Letter Burns. There are residential properties in this zone and new planting on the lower slopes.
5	Primrose Hill	This area is the most heavily used for visitors, focused around the Trossachs Pier visitor hub (which is out with the LMP area) and the loch shore and Primrose Hill forest roads. The mature woodland in this location creates an enclosed wooded feel, with the landscape opening up on the higher slopes to the east. Alongside the holiday cabins located in close proximity to the Trossachs Pier, there is one residential] property in this zone.
6	Arklet South	This zone incorporates the north facing slopes to the south of Loch Arklet and the land between the two lochs, east of Arklet. This eastern area includes the underground feeder pipes between the two lochs, as well as a telephone mast and the overhead electricity pylons and has a sparse level of tree cover, which gives this area a more developed feel. However, the views westwards over the loch and the hillside counteract this with a sense of openness and wildness (further influenced by relative inaccessibility) respectively. There is new woodland planting on the lower slopes south of the loch with an open area around Corrieachan.



Zone	Location	Common Attributes
7	Katrine South	While there are some properties along the southern shore of Loch Katrine and the outfall pipes for the water supply by Royal Cottage, this area has a general sense of remoteness. In particular, the ground at the lower slopes of Ben Venue is difficult to move across. New woodland planting has established well here and contributes to a wooded enclosed character the lower slopes with the higher slopes, including around Loch Tinker, being more open and exposed. The existing access track does not extend beyond the property at Glassahoile.

Table 3: Loch Katrine LMP zoning

3 Plan Objectives

Reference: Appendix I – 2 Analysis of the previous plan & 2.1 Aims and objectives includes a detailed review of the previous plan's objectives and achievements.

An FLS internal briefing considered the previous Forest Design Plan (FDP) and outlined the key issues and challenges faced. A further internal FLS scoping, as well as public scoping, refined the objectives detailing the key issue and challenges faced **Appendix III**. Feedback and comments from this meeting were combined with detail from desk and site surveys, as well as liaison with key stakeholders. This information gathered during this process was then used to generate specific management proposals and prescriptions, which are outlined in **Section 5 Land Management Proposals**.

Section 4 Analysis and concept illustrates how the information gathered, was systematically analysed to identify important features, constraints and opportunities within the catchment; and how these relate to the overarching management objectives.

Management Objective	Description
Water Quality	Safe guard the strategic water supply of Loch Katrine. Exploring natural mitigation measures so as to reduce sedimentation and the risk of landslides. Managing the land to respond to natural processes into the future, in an ever changing climate.
Access	Improve access in the catchment to assist in long term management and improved safety for delivery teams.
Herbivore impact	Reduce the impact of deer, sheep and goats pressure which are impacting on natural regeneration and open habitats. Collaborate with neighbours at a landscape scale.
Carbon Capture	Explore the opportunities to restore areas of peatland habitat and woodland creation to help achieve government targets for carbon capture.



Management Objective	Description
Biodiversity	<p>Reconnect, protect and enhance native habitats (designated sites) to create a sustainable ecosystem which can respond to natural processes and changes into the future.</p> <p>Restore ancient woodland sites when non-native species are clearfelled. Remove invasive natural regeneration, including Sitka spruce, western hemlock and Rhododendron from priority sites.</p>
Resilience	<p>Clearfell the larch during the plan period to mitigate against the risk of <i>Phytophthora ramorum</i> disease. Remove non-native conifers as part of a programme to deliver a restoration of the Plantation on Ancient Woodlands (PAWS), and reduce any future seed sources which aid the spread of non-native species.</p> <p>Woodland creation in the upper elevations will be developed with a focus on natural regeneration. Seed islands will be established with pioneer species, with future woodland developing with greater diversity, once soil and microclimate have evolved through succession.</p>
Visual	<p>Maintain views from within the catchment for iconic settings which are important to the local communities and visitors.</p> <p>Examine longer term opportunities to expand the native woodland onto the higher elevations of open ground, whilst retaining the element of wildness associated with the higher hillsides and crags.</p>

Table 4: Loch Katrine LMP Objectives



4 Analysis and concept

4.1 Analysis

Through the undertaking of surveys as well as wider research, a broad range of factors have been identified which are relevant to the future make-up and management of this catchment. These have been analysed below in **Table 5**, so as to better understand the way these important issues interact, helping to draw out the most important features. Where an objective has an opportunity to mitigate and/or improve the land condition, reflective of Climate change, as well as to seek an undertaking to help contribute towards current government objectives for 'Net Zero targets' and 'Biodiversity loss', this has been noted next to the objective.



Table 5: Illustration of how the analysis of the opportunities and constraints of an objective leads to the plan concept.

Objective	Opportunities	Constraints	Concept
<p>Water Quality: 'Climate change'</p> <p>Safe guard the strategic water supply of Loch Katrine. Explore mitigation measures to reduce sedimentation and the risk of landslides. Managing the land to respond to natural processes in an ever changing climate.</p>	<p>Increasing woodland cover will intercept rainfall, increase transpiration, increase the filtration of surface water and slow down the flow of surface water flow within the upper catchment. Slope stabilisation will reduce sediment loading on the riparian system associated with landslips (debris flows) across the catchment.</p> <p>Throughout the catchment there are a number of Glens such as Glen Gyle or Corriearklet; which have steep sided slopes which are exposed to the climatic elements and would benefit from the establishment of new riparian woodland. Connecting the lower elevation into the upper elevations and or hill tops.</p>	<p>Fencing design and location may create problems in which to protect planted or natural regeneration trees along the riparian corridor.</p> <p>The breadth of tree species and silvicultural systems that are suited to the site is largely limited by high levels of exposure and poor nutrient availability.</p> <p>Access to areas of the riparian corridors will be challenging, therefore a focused effort will be required to target certain areas for planting or seeding. This can then be co-ordinated with Wildlife control.</p>	<p>Riparian planting will take place along the watercourses by adding a buffer zone appropriate to the size of the burn.</p> <p>A random planting along the length of the burn, which will be undertaken at a wide spacing, as well as focused at specific locations, will be designed to create a seed source for the future riparian woodland. Which will develop over time through natural regeneration.</p> <p>Individual trees or groups of trees, clustered together, will be protected with the use of an 'easy-to-construct' design using metal wire netting and posts/stakes. This will be designed for easy transport, assemblage and to potentially re-use in the same location for future development of seed sources. This also avoids the need to use plastics which have an associated requirement and obligation to remove. The use of biodegradable (non-plastic) products for tree protection, will be explored throughout the LMP period, should such products be developed and prove to be viable for use.</p> <p>Fencing of sections of the watercourse will be avoided, so as to ensure wildlife can move freely throughout the catchment and reach the water.</p> <p>Opportunities to enhance existing natural peatlands, through operations such as drain blocking will be undertaken to prevent further erosion of historic man-made drains and active peat erosion. Tree planting within the burns, associated with peatlands, using willow scrub will help to stabilize and prevent future erosion of peat. Forestry and Land Scotland comply with current industry best practice guidelines (e.g. Forest and water guidelines) and UKFS stipulations in order to protect water quality throughout all forest operations.</p>



Objective	Opportunities	Constraints	Concept
<p>Access: Improve access in the catchment to facilitate long term management and undertaking of harvesting operations</p> <p>Providing <u>safe long terms routes</u> for operators to use into the future, as the landscape and habitats evolve over time through natural succession.</p>	<p>Extend an existing forest road and construct a temporary forwarding track to access a harvesting block for the undertaking of PAWS restoration.</p> <p>Potential to <u>create safer access routes</u> for quad and off road i.e. 'cross-country' routes, for the management and delivery of woodland creation, peatland restoration and long term wildlife control. This would involve benching works, focused in key locations, which exhibit excessive side slope or require a crossing point.</p>	<p>Provision of access routes is limited by installation and maintenance costs and must be balanced with future forest operations/maintenance and access requirements.</p> <p>Sedimentation and leakage of hydrocarbons from machinery is a critical consideration. Therefore the planning and delivery of the operation must be undertaken with the utmost care and with approval from Scottish Water. <u>Forest and water guidelines to be followed at all times during operations.</u></p>	<p>Forwarding track and road extensions have been planned within locations that have already advanced natural regeneration. This will help to conceal the hard infrastructure from any short term visual impacts from the Loch and or surrounding hills. Forwarding tracks will be a temporary feature, designed to facilitate the PAWS operational delivery. These will then be re-profiled back to a quad track following the completion of harvesting operations.</p> <p>Quad routes are predominately 'off-road' or 'cross-country' with only a small quantity of works required to improve accessibility and therefore safety for users. This will be focused in key locations over short distances only to negotiate impassable locations which are currently identified as 'pinch points' and unsafe to negotiate. This will overcome access restrictions in the catchment which currently present a Health and Safety risk for FLS staff and contractors during operations.</p> <p>All routes will be discussed with Scottish Water and mitigation delivery measure will be put in place as required to protect the catchment. Forestry and Land Scotland comply with current industry best practice guidelines (e.g. Forest and water guidelines) and UKFS stipulations in order to protect water quality throughout all forest operations.</p>



Objective	Opportunities	Constraints	Concept
Herbivore impact: Reduce the impact of herbivore pressure i.e. deer, sheep and goats which are impacting on natural regeneration development as well as degrading open habitats by limiting the return of native vegetation/shrubs. Collaborate with neighbours and deer management groups to look at populations at a landscape scale to co-ordinate a joint effort and to align objectives and interests for the benefit of protecting native habitats.	Restore areas of priority open habitat associated with peatland. Re-profile peat hags and block drains to re-wet habitats which function as a wider hydrological unit. Allow natural regeneration to take place. Native woodland expansion throughout the catchment is preferred, sourced from a local seed source, so as to ensure the 'right tree' to develop in the 'right location'. Collection of seed from isolated trees in higher elevations, will provide potential for wider seed production.	Sheep from adjacent land, which are hefted to areas of Loch Katrine catchment. Goat population, associated with Rob Roy and historic grazing. Transient deer populations moving into the catchment for shelter. Neighbouring landowners with interests in higher deer numbers and or grazing. No march fence to prevent the movement of gazing animals such as sheep.	Maintain and increase the deer cull long term, focusing on the hinds to reduce the population. Collaborate with our neighbours and the Deer Management groups (DMG) to look at deer management at the landscape scale. Focus efforts together and look at different ways to manage deer populations in the landscape. Use technology to focus resource and efforts in key locations for targeted control. Improve access for long term management from herbivores which favour tree cover. This is critical once the woodland develops in the future. Loch Katrine will be subject to a formal and strategic deer management programme, guided by population surveys and Herbivore Impact Assessments.
Carbon capture: 'Climate change' Explore the opportunities to restore areas of peatland and expand woodland creation to achieve government targets for carbon capture relating to Climate change.	Woodland creation: Encourage and develop the expansion of the woodland using native broadleaved species found within the catchment. Focus on natural processes to mimic a natural succession to help develop the soils and environment to allow the woodland to develop and expand to its natural range. Peatland restoration: 1. Re-wet areas of peatland habitat through direct intervention of drain blocking and hag reforming; 2. Re-profile exposed slopes and revegetate the peat, protecting from browsing animals, to prevent further erosion and release of carbon.	Herbivore impacts: Deer, sheep and goats present a challenge to establishing trees and expanding the woodland cover. Landscape scale buy-in is required to achieve effective deer control. Accessing areas of higher elevation with machinery to facilitate peatland restoration	Focus drain blocking and hag re-profiling in areas of the catchment which can be safely accessed by machinery, or that will have the greatest impact. Allow for collaboration to the adjoining lands, so as to have an effect at a larger landscape level in rewetting this habitat. Protect and stabilise re-profiled hags and blocked drain areas by fencing and planting of native vegetation. Woodland creation will focus in the riparian zones as well as the upper elevation to create a seed bank or 'seed island'. An establishment of seed island stands will then aid the development of natural regeneration in the upland areas, to which there is no current seed source. It will also safeguard this future seed source, despite fluctuations or changes in land management, so as to allow for natural processes of regeneration to develop long-term.



Objective	Opportunities	Constraints	Concept
<p>Biodiversity: Climate change</p> <p>Reconnect, protect and enhance native habitats (designated sites) to create a sustainable ecosystem which can respond to natural processes and changes into the future. Restore ancient woodland sites when non-native species are clearfelled. Remove invasive natural regeneration, including Sitka spruce, western hemlock and Rhododendron from priority sites.</p>	<p>Create a woodland which will develop into a climax forest as part of the temperate rainforest.</p> <p>Establish a pioneer native woodland, which contributes to the development of an upland woodland transitional habitat</p> <p>New woodland creation will contribute to Scottish Government woodland expansion targets without sacrificing productive agricultural area.</p> <p>Updating and improving deer management will protect new woodland from browsing damage and improve opportunities for natural regeneration of both herbaceous and woody species.</p>	<p>Historic land use has degraded soils and effected drainage patterns. The nutrient availability will be lacking due to destruction of natural soil structure through intensive burning regimes. The range of site suitable tree species and the initial productivity potential of the soil is subsequently altered.</p> <p>Tree planting area must be balanced with open space and to contribute toward other habitat, water, and recreation objectives to fulfil UKFS and UKWAS requirements.</p> <p>Landscape scale buy-in is required to achieve effective deer control.</p>	<p>Establish a pioneer native woodland, which contributes to the development of an upland woodland habitat.</p> <p>Establish islands of pioneer species in areas identified as not 'priority habitat' and are suitable for tree growth. This will be established with a pioneer species as well as an occasional nurse species such as Scot pine, to improve the soil nutrient regime, structure and microbiology, as well as to reduce exposure (micro-climate).</p> <p>Focus planting within the riparian zones, which branch up the glens and to the hill tops to reach identified locations suitable to establish as an island of establishment</p> <p>A wider range of species will be established on lower slopes where exposure levels and soils types are more favourable, and where they can best contribute to visual and species diversity.</p>



Objective	Opportunities	Constraints	Concept
<p>Resilience: Climate change</p> <p>Clearfell the larch during the plan period to mitigate against the risk of P.Ramorum disease. Remove non-native conifers as part of a programme to deliver a restoration of the Plantation on Ancient Woodlands Sites (PAWS) and to reduce any future seed source</p> <p>Future woodland and habitats: A development of the woodland through natural succession to match local bio geoclimatic conditions developing over extended period of time</p>	<p>Restore Plantation on Ancient Woodland Sites (PAWS). Existing coniferous woodland requires clearfelling as many are starting to show signs of windblow instability and seeding out into the wider catchment.</p> <p>Larch is a component of the coniferous blocks and will likely succumb to P.Ramorum disease. Pre-emptive removal will help to create a buffer for the larch to the east as part of the FLS revised larch strategy.</p> <p>Improve the soil conditions and microclimate through a successional process using pioneer tree species such as birch. Later diversification of tree species will progress gradually and naturally once conditions have improved in the microsite</p>	<p>The primrose block is adjacent to the SSSI/SAC.</p> <p>Primrose block is located to the Trossachs pier and has ever increasing public use.</p> <p>Upper levels of woodland creation are exposed with degraded soil conditions. Growing season is short with a lack of seed source and high browsing damage from herbivores.</p>	<p>Clearfell all coniferous spruce, retaining the native Scots pine.</p> <p>The Douglas fir will be retained as a component of the PAWS, forming a long term retention, but allowed to decline over a long period of time to eventually leave a few isolated large trees. These veteran trees will form a component of the much more extensive native woodland which will be encourage to regenerate.</p> <p>Woodland creation in the upper elevations will be developed with a focus on natural regeneration. Seed islands will be established with pioneer species in the upper levels. Management of this future seed source will be developed for over 10-20 years, after which seed should start to be produced.</p> <p>Future woodland will develop with a greater diversity of species, such as Oak, Hazel and Holly, once the soil conditions have improved and the microclimate has evolved through succession with the development of mutual sheltering to mitigate against the current exposure. Initially the trees will be stunted and twisted due to the extreme exposure, however over time as cover increases and mutual sheltering develops, the trees will start to take a different form.</p> <p>Upper levels will be transitional into montane, so trees here will be stunted and remain in a twisted form as they move into dwarf species of tree and shrub.</p>



Objective	Opportunities	Constraints	Concept
Visual: Maintain views from within the catchment for iconic settings which are important to local communities and visitors. Examine longer term opportunities to expand the native woodland onto the higher elevations of open ground, whilst retaining the element of wildness associated with the higher hillsides and crags.	Provide an interesting and diverse setting for recreational use and community benefits associated with Loch Katrine and Loch Arklet.	Natural regeneration developing on mineral knolls within the visual sensitive locations. Long-term management required to keep these to an acceptable and manageable level so as to maintain the desired viewpoints, which are currently identified as a priority.	<p>The established forest road network on site will be maintained in line with operational use and public pedestrian access. Maintenance of open views, located at key points, will be undertaken by focused grazing.</p> <p>Trees will be allowed to develop over time in high visual locations, but maintained at wide spacing, so as to allow for open space in between to avoid blocking of views. This will balance biodiversity benefits whilst retaining some natural regenerating tree cover that will not obscure iconic visual points. Key visual points will have a designated focused area, i.e. a window of open ground, which will be maintained as open space through active management. This will allow people to appreciate these iconic views into the future.</p>



4.2 Concept

An analysis of the catchment was developed spatially in the '**Initial Analysis & Concept**' M3 which highlighted the general themes as well as outlining key considerations and activities, which are likely to be most relevant during the plan period. These have formed the basis for the plan proposals put out for consultation, with both the public and key stakeholders **Reference: M3 - 'Initial Analysis & Concept', and M4 - 'Final Concept' map.**

The accompanying '**Final Concept map**' spatially illustrates the strategies to deliver the plan objectives with the site specific opportunities and constraints, detailed above taken into account.

- Improve access for long term delivery of wildlife management.
- Early and rapid removal of the coniferous stands within the PAWS areas, with a removal of the larch.
- Maintenance of existing ancient woodland and seeking opportunities to extend the area of native woodland around those.
- Undertake peatland restoration to reduce erosion of peat and the release of carbon.
- Undertake woodland creation within riparian zones and areas of rock slope failure to help stabilise and mitigate against further debris flows
- Protect, maintain and enhance designated sites, in particular avoiding damage during forest operations.
- Removal of non-native invasives, such as naturally regenerating Sitka spruce and Rhododendron from designated sites and certain open hill situations.
- Continue to expand the forest habitat network to improve biodiversity conditions to aid the development of priority bird and mammal species.



5.0 Land Management proposals

This section provides detail on land management proposals for the site. Activities scheduled for the current planning period, 2023-2032, as well as the long-term management prescription for the ‘future forest’, are both covered.

The accompanying ‘**Future Habitats**’ map **M18** illustrates the vision towards which the prescriptions, as detailed below, are working toward. The woodland creation maps **M16.0-M17.2** illustrate how we will work towards achieving this vision, during the first ten years, through new woodland creation. The table and charts below illustrate the land use breakdown once proposals in this plan have been delivered.

Future Land Use (100+ years)	Gross Area (Ha)
Seed Island zone	1662
Natural Regeneration Zone	1,596
Riparian zone	528
Transitional Woodland Zone	595
Open Habitat (Deeppeat, Priority OH, buffer and GWDTE)	2,527
Scottish Forestry Alliance (SFA) Phase#1	1,677
Existing Woodland	953
Other	60
Total	9,598

Table 6: Loch Katrine LMP Future proposals on Land use



Loch Katrine-Potential Landuse LMP 2024-2034

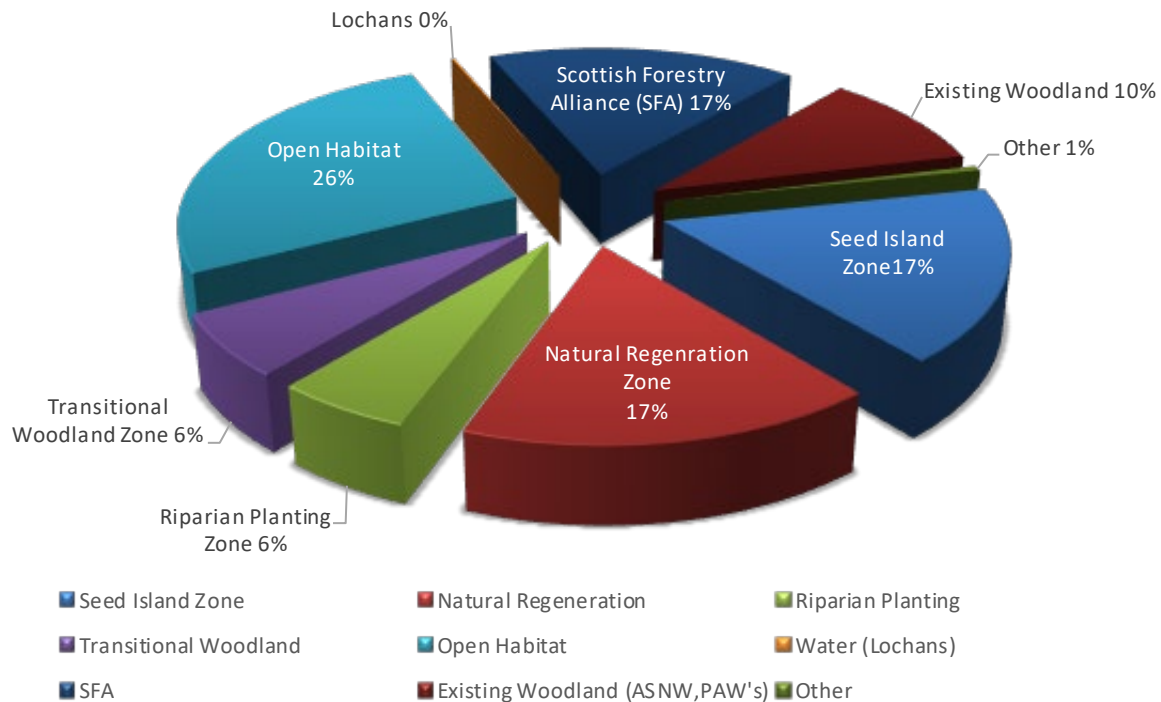


Figure 3- The potential land use (LMP 2023-2032)

5.1 Management of existing woodland. Ancient Semi Natural Woodland (ASNW)

The Ancient existing woodland at Loch Katrine and Loch Arklet covers an area of 817 ha. This forms part of Special Area of Conservation (SAC) and Special Site of Scientific Interest (SSSI), defined as an 'Acid Oak woodland', of which parts fall within the designated 'Temperate Rainforest Zone' (TRZ).

The ASNW which forms a high forest structure has been achieved through historical management and indeed in the past this forest was harvested for both sawlogs and charcoal as well as other products.

There is no desire to manage this designated native woodland productively, however this may be considered in future plans as the native woodland expands into to a larger area of the catchment. However the control of invasive species, outlined in [Section - 7.2.5 Invasive species, & Appendix I - 3.4.4 Invasive Non-Native species](#), will form a critical objective of this LMP to maintain and improve the condition of the designated sites.

To encourage a diversity of structure within the uniform oak stand there is an opportunity to actively plant oak seedlings, from acorns sourced within the ASNW within windblown areas. [Reference: Appendix I Section 3.4.2 Ancient Woodland Management.](#)



There are no planned operations to take place within the SAC and SSSI woodland. Only emergency clearance will be undertaken if required, such as with tree felling in exceptional circumstances.

5.1.1 Clearfelling

During the 10 year period of the LMP, a total of 30 ha with a projected volume of 11,719 m³ will be designed for clearfelling (see table and figure below). **Reference: M7.0 - Management overall**, shows the Plantation on Ancient Woodland Sites (PAWS) plantations for which approval is sought for clearfelling during the plan period, with reference maps **M7.1.1-5** detailing specific locations (**Primrose, Letter, School House and Glen Gyle**).

The proposed felling structure through a phasing of the operations, Phase 1 & 2, has been designed to achieve the key objective, in particular, the early removal of larch, as well as the non-native Sitka spruce, to prevent further expansion of non-native regeneration within the ASNW and wider habitats.

Clear Felling	Phase 1
Area (Ha) School House, Glen Gyle & Arklet	29.7
Volume (m ³)	10,124
Fell-To-Recycle	Phase 1
Area (Ha) Primrose, School House, Letter (ha)	37.1
Volume (m ³)	1,595
Total Area (Ha)	66.8
Total Volume (m³)	11,719

Table 7: Projected phased felling volumes

Primrose PAWS restoration

The impacts of delivering the PAWS restoration through a harvesting operation for Primrose hill coniferous block have been assessed as to challenging, with impacts that would affect the public access and infrastructure that it has been deemed not viable to deliver. It is then proposed that the PAWS block is retained as a Long Term Retention (LTR), and a conversion to broadleaved woodland is managed over a longer time span. This would follow a similar regime as prescribed for the Douglas fir LTR, located in an adjacent forest block through a minimum intervention.

The Norway spruce would therefore be retained as it does not present a risk with regards to invasive spread, via natural regeneration both within the block and further afield. The Norway spruce is



currently destabilising as a stand through a combination of windblow and wind snap. Left unchecked this will gradually progress throughout the forest block to form a mix of wind-snap and windblown stems. It would therefore be proposed to leave the windblown Norway spruce, either as standing or fallen dead wood, allowing natural regeneration of broadleaved trees to take place within the gaps formed. The larch, would be felled by hand in areas which are in close proximity to a forest road, as part of a pre-emptive felling for *P. ramorum* disease. Larch which is located further within the forest block, which is inaccessible by public, would be killed standing with the use of chemical stem injection, using Glyphosate plugs or by ring barking. Given the low density of larch within the stand, which is not accessible by the public, it is envisaged that this will create conditions which are suitable for the regeneration of broadleaved trees to take place within the understory.

All harvesting operations will be conducted in accordance with the *UK Forestry Standard Guidelines*, and *Forests and Water Guidelines (5th edition)*. The necessity of avoiding contamination of the reservoir and maintaining water quality in burns and rivers will be managed and observed during operations. In areas of high public use, winter working will be the preferred option. Where this is not possible for certain operations, such as tree felling and or haulage, this will be managed to minimise disruption without compromising environment and or safety.

5.1.2 Long Term Retentions PAWS

There are a number of proposed Long-term retentions (LTR's) within the catchment, which are primarily associated with the Plantations on Ancient Woodland Sites (PAWS). It is proposed that these stands are allowed to gradually open out through natural processes, as well as a series of light touch minimum intervention to be implemented over longer term periods. Interventions could be individual tree felling or as small groups to create small openings within the stand.

Within the PAWS area it is intended that native broadleaves will then be allowed to regenerate naturally or through the addition of native broadleaved species by means of supplementary planting. This will allow for a subtle and gradual movement of the conifer plantation towards a mixed native woodland, with a minor component and retention of veteran conifer trees.

Within the ASNW there are isolated patches of native conifer, primarily Scots pine. These will be retained as part of the LTR and allowed to thin out naturally to form a mixed stand over time, dominated by native broadleaves.

Douglas-fir block: A stand of Douglas fir (*Pseudotsuga menziesii*), a non-native coniferous species, can be found along the North Shore road which has grown to form an iconic and much loved feature. It's grand stature and aesthetics are visually desired by the public in this particular location, which is situated within walking distance of the Trossachs pier. This area hosts a much frequented tourist attraction for Loch Katrine, the Sir Walter Scott Steam Ship. This coniferous species presents a low risk with natural regeneration as is considered to be not an aggressive tree and is also vulnerable to browsing damage from deer. Its retention is therefore considered to be advantageous in the short term. Douglas fir will be of some benefit to the red squirrel (*Sciurus vulgaris*) found in the area as well as other mammalian animals as a food source. It is therefore proposed to leave the Douglas fir to grow into old age, forming isolated



clumps or isolated individual trees, which will mature and eventually die and function as a form of standing or fallen deadwood.

Small group openings have formed over time as a result of windblow, naturally thinning the Douglas fir stand. It is therefore proposed that natural regeneration of native broadleaves will be allowed to develop from seed sourced from the adjacent woodland. An introduction of Sessile Oak (*Quercus petraea*) and or common hazel (*Corylus avellana*) may be desired to increase the diversity of species.

The Douglas fir will be retained to function as a large iconic tree within this location, but will over time exist at much lower densities as this woodland phases towards a native broadleaved stand, connecting to the adjacent ASNW.

5.1.3 Woodland Pasture

The woodland pasture consisting of alder stools, coppiced for charcoal, and forming part of a historic agro-forestry system. This open woodland habitat is in decline throughout the catchment and forms an important habitat for some rare lichens and ferns. Although no felling will be proposed for this area, there is potential to coppice some trees, less than <10cm in diameter, to allow the stools to regenerate and prolong their structure and form. These areas will be considered for biodiversity improvement and or to potentially undertake future planned grazing operations, reviving this old agro-forestry management practice.

5.1.4 Tree felling invasive coniferous regeneration

There are a number of coniferous plantations which were not removed during the previous harvesting operations undertaken by Forest Enterprise Scotland, as part of the last FDP, as well as under the water authority (either Scottish Water or West of Scotland Water). Further to this a number of Sitka spruce trees have regenerated naturally over time, growing to such a size that they are now presenting a considerable risk to further invasive seeding. This natural regeneration has moved further afield, outwith the plantation areas, and into neighbouring SAC/SSSI and the open hill above.

It is therefore proposed to fell these trees to recycle, or kill standing, if appropriate (not within public access and or are too dangerous to fell safely by hand or machine). **Reference: M7.2 - Management SS regeneration**, which details the locations.

Location	Phase	Area (Ha)	Volume (m ³)	Comment
Primrose	1&2	414	Volume estimate is between 1 m ³ /ha to 3 m ³ /ha	Sitka spruce regeneration. Located in clumps and or sporadic individuals throughout the area
Letter	1&2	19	Volume estimate is 1-3 m ³ /ha	
School House	1&2	165	Volume estimate is between 1 m ³ /ha to 2 m ³ /ha	"
Glen Gyle	1&2	74	Volume estimate is 1 m ³ /ha	"
South Katrine	1&2	265	Volume estimate is between 1 m ³ /ha to 2 m ³ /ha	"
North Arklet	1&2	78	Volume estimate is 1 m ³ /ha	"

Table 8: Tree felling for non-native, coniferous regeneration



5.1.5 Other Tree Felling in Exceptional Circumstances

FLS will normally seek to map and identify all planned tree felling in advance through the LMP process. However, there are some circumstances requiring small scale tree felling where this may not be possible and where it may be impractical to apply for a separate felling permission due to the risks or impacts of delaying the felling.

There are substantial areas that will be managed for habitat, visitor services and infrastructure management. Management will include removal of undesirable natural regeneration, of any species, from, for example, sensitive habitats, visitor zones and road lines. Although most of this work will be carried out before the species concerned become too large there will, inevitably, be some growth with diameters in excess of 10cm. The areas where this work might be carried out are indicated in map **M7.2** which shows areas requiring the removal of non-native Sitka spruce regeneration **Reference: M7.2 - Management SS regeneration.**

In these areas, single trees or small groups of trees will be removed when necessary to protect facilities, infrastructure, and trails, to enhance the setting of features, or to maintain existing views. Also, in these zones, woodland might be thinned, or trees re-spaced, for reasons other than safety, (including to increase visibility to ensure that sites are welcoming and feel safe) and where it is necessary to enhance the experience of the forest setting, through the development of large trees, or preferential removal of trees to favour a particular species. Volumes from all these works are likely to be relatively insignificant, in the order of 1m³ per/ha to 10m³ per/ha over the plan period.

Felling permission is therefore sought for the LMP approval period to cover the following circumstances:

- Individual trees, rows of trees or small groups of trees that are impacting on important infrastructure (as defined below*), either because they are now encroaching on or have been destabilised or made unsafe by wind, physical damage, or impeded drainage.

*Infrastructure includes forest roads, footpaths, access (vehicle, cycle, horse walking) routes, buildings, utilities and services, and drains.

The maximum volume of felling in exceptional circumstances covered by this approval is 75 cubic metres per Land Management Plan per calendar year. A record of the volume felled in this way will be maintained and will be considered during the five year Land Management Plan review.

It is also likely that there is low density larch throughout the plan area and permission is sought to remove these and any necessary closely associated trees; the total volume of unmapped very low density larch and closely associated species is not likely to exceed 1m³ per/ha to 2m³ per/ha over the lifetime of the plan.

6.0 Restocking proposals, future habitat and species

The objectives outlined in the brief propose a conversion of the clearfell areas, coniferous plantations on PAWS, to be returned to a native broadleaved stands.



The woodland will be matched to the soils and ground vegetation, using guidelines set out in the Forestry Commission's Ecological Site Classification (ESC) Bulletin 124.

6.1 Proposed Restocking Species

As the restocking sites are located on PAWS areas, the restocking species has been matched to the adjacent ancient woodland. It is proposed wherever possible to allow natural regeneration to take place within the restock sites to take advantage of the locally abundant seed source in the adjacent native broadleaved stands.

Pioneer species, such as downy birch (*Betula pubescens*) and or silver birch (*Betula pendula*), will naturally regenerate quickly into disturbed open spaces, such as a harvesting site. This will aid in soil improvement, as well as situating the 'right tree' in the 'right place' through a natural succession of local genetic material. The nearby seed source will allow trees to form a better rooting structure as a result of natural regeneration, rather than being transplanted, as well as to have a compatibility with the local site conditions.

Species	Total Restock Area (Ha)	Open Space	Net Area (Ha)	% Component	Total area (Ha)
Sessile Oak (<i>Quercus petraea</i>)	29	12	25.5	38	9.7
Silver Birch (<i>Betula pendula</i>)/ Downy Birch (<i>Betula pubescens</i>)				60	15.3
Minor species: Hazel (<i>Corylus avellana</i>) Common alder in riparian areas and Holly (<i>Ilex aquifolium</i>), Wild cherry (<i>Prunus avium</i>), as well as shrub species such as Elderberry (<i>Sambucus nigra</i>), Guelder rose (<i>Viburnum opulus</i>) and Dog Rose (<i>Rosa canina</i>)				2	0.5

Table 9: Restock prescription, total area

Restocking proposals, **Reference: M8.1-5 (Primrose/Letter, School House, Glen Gyle & North Arklet)**, are shown. Restocking of the forest blocks will be undertaken with the use of native broadleaved species. Locations which have a source of seed from adjacent existing woodland, natural regeneration as a means to restocking areas within the PAWS will be utilised. It is expected that this will be dominated by birch predominately. A focused planting of other key native species will be undertaken to maintain a diversity of woodland species within the location.

Table 9 above highlights areas which have regenerated with Sitka spruce, in adjacency to the PAWS blocks, which will be proposed for felling to recycle, or killed as standing. As these trees form a patchy cover in their distribution, (groups or individual large trees), as well as in their size and quality with many being heavily branched, it is deemed that to retrieve these timber commercially would not be productive. Therefore a felling to waste is deemed more appropriate, putting the timber to an environmental use in the form of dead wood. These areas will regenerate with birch seed, which is in plentiful supply from the adjacent stands of native birch.



On the majority of PAWS restoration sites programmed for clearfell, an overall density of at least 1,100 stems per hectare (sph) will be achieved. Transitional areas, such as upper tree lines, lower densities of between 600 sph and 1,100 sph, will be accepted. Natural regeneration sites will be assessed five to eight years after felling. If it seems unlikely regeneration will become established by year 10, the site will be planted to achieve the desired stocking level at year 10.

Large amounts of rhododendron are known to be present in some areas, and appropriate measures to control this species will be planned.

7.0 Prescriptions

7.0.1 Ancient Semi-Natural Woodland (ASNW)

Reference: Appendix I - Section 3.4.2 Ancient woodland Management

The natural seeding and distribution of the invasive species *Rhododendron ponticum* remains a key priority for management within the ASNW as well as throughout the catchment. Its seed source is mainly located within the various private ownerships located throughout the Loch, or adjacent to the ASNW sites. FLS, Scottish Water (SW) and the Loch Lomond and Trossachs National Park (LLTNP) are collaborating together to engage with our neighbours, to provide options for its removal.

Control of Rhododendron has historically been undertaken through the method of cutting stems, burning stems and treating stumps with a further application of Glyphosate, or an overspray to smaller regenerating shrubs. FLS are now seeking to reduce the chemical application on site by focusing on stem injection with the use of Glyphosate, to reduce both chemical use on site as well as to target its application more effectively. This avoids the over spraying which presents a risk with regards to run off. FLS may require the use of an overspray application, in some circumstances, but the default application of chemical will be through the stem injection method.

7.0.2 Native woodland (Phase #1 – Scottish Forestry Alliance (SFA))

The Scottish Forestry Alliance makes up approximately 17% of the catchment with a gross area of 1677.7ha, **Reference: M5 – Scottish Forestry Alliance (SFA).**

The woodland creation undertaken within the Scottish Forestry Alliance project lands will be maintained to a standard, as per a contractual agreement with BP, which is focused specifically to carbon sequestration. During 2019 a series of landslips, as well as COVID-19 restrictions, prevented site access for FLS operational teams to undertake inspection and maintenance for many of the sites within this area. A number of fenced exclosures were damaged as a result, which led to an increase in herbivore damage to the planted trees within the exclosure. Restocking of areas, as well as further fence maintenance, for the affected areas will be undertaken, to ensure the contractual areas meet the required specifications.



7.0.3 Riparian Habitat

To establish a riparian corridor which links the Loch to the upland elevations, various buffers have been applied to the river networks throughout the catchment associated with the elevation.

Reference: M15 Watercourse-Riparian corridor.

- **LOWER Elevations** (approximately 130m-250m): Common alder (CAR): 15m buffer applied either side of the watercourse to provide a 30m corridor.
- **MID Elevations** (approximately 250m-350m): Common Alder (CAR)/Birch (BI)/Aspen (ASP)/Sessile Oak (SOK)/Hazel (HAZ): 10m buffer applied either side of the watercourse to provide a 20m corridor.
- **UPPER Elevations** (approximately 350-400m+): WILLOW/BI/CAR/Hawthorn (HAW)/Blackthorn (SLO): 5m buffer applied either side of the watercourse to provide a 10m corridor.

Forestry and Land Scotland comply with current industry best practice guidelines (e.g. Forest and water guidelines) and UKFS stipulations in order to protect water quality throughout all forest operations.

7.0.4 Open Habitat & Space

Reference: Appendix II section 3.5.6 Conservation grazing. Iconic viewpoints, which are also commonly associated with ground nesting birds and their breeding sites (Leks), such as with the black grouse will be maintained as open. This will be achieved through a management regime of strimming as well as controlled grazing, through the use of cattle (Highland and shorthorn breeds).

Cattle: Cattle are non-selective graziers and will form an important dynamic within the catchment long term, once deer pressures can be reduced and brought to a sustainable level. FLS are in discussion with our neighbours in the west at RSPB Inversaid and in the east with the Woodland Trust at Glen Finglas. Cattle are a both a historic and important component of any 'natural' woodland system, providing a degree of ground disturbance which can be beneficial if maintained at the right impact levels. There is an aspiration to combine the use of cattle on site, long term, as part of the 'Great Trossachs Forest', fulfilling a role for biodiversity enhancement, bracken control and fire control. This role could be further expanded to the woodland pasture, located in various areas of the catchment; such as in Glen Gyle and South Katrine.

Wayleave (OHPL): Scottish Power Energy Network (SPEN) have an Over Head Powerline (OHPL) 275KV towerline which runs through Glen Gyle, Arklet North and South Arklet areas and functions as a strategic asset. Along the OHPL wayleave, FLS will avoid planting trees which can reach a higher height stature, potentially impacting on the OHPL wayleave agreement and infrastructure. To the north of Glen Gyle, the burn deepens into a riparian gully, which presents an opportunity for planting scrub species and/or lower stature trees within the watercourse buffer as a means to mitigate against bank erosion and peak flows. This form of planting will be done in conjunction with SPEN seeking guidance and mitigation as provided from the utility provider.



7.0.5 Minimum intervention

Once established, the mixed broadleaf and native wet woodland will be managed under a minimum intervention prescription. The primary long-term intention of these areas is to provide ecological benefits associated with this habitat type. These include deadwood accumulation, protection of water quality and provision of habitat niches for associated species.

Thinning of larch will be undertaken as required in areas of the catchment such as Primrose hill. Larch spp. will be specifically targeted for removal. This approach could be described as single tree- or group-selection thinning; it should be noted that the intention will be to fell all larch from these areas as a 'Fell-to-Recycle' operation. In these thinning areas, volumes removed will not exceed 50m³ha⁻¹ over the plan period.

Reference: M7.1.1-5.

7.0.6 VIEW project-screening hard infrastructure

Scottish Power Energy Network (SPEN) have an Over Head Powerline (OHPL) 275KV towerline which runs through Glen Gyle, Arklet North and South Arklet area and functions as a strategic asset. This asset was unable to be hidden through undergrounding of the electric cable system. As this hard infrastructure is within the LLTNP and NSA, it impacts on the visual quality of the area. SPEN have an obligation to mitigate and screen their infrastructure wherever possible, which will be developed through the VIEW project. This project has a series of plans through tree planting to screen, viewpoints to direct the public sight away from the OHPL etc.

FLS collaborate with SPEN, as part of the VIEW project, to naturally screen this hard infrastructure; given its location within the National Scenic Area (NSA) and NNR. As part of the LLTNP, NSA and Natural Nature Reserve (NNR), FLS have an opportunity to screen this hard infrastructure subtly with the use of trees and or shrubs, along the Eve's road within Glen Gyle. This is an area to which most hill walkers view this hard infrastructure on the horizon, when looking south east to Loch Katrine. Woodland creation will form an important contribution in mitigating against any visual impacts within the NSA/NNR for the future.

7.1 Seed Island, Riparian & Natural Regeneration Zones

7.1.1 Natural Regeneration survey and concept

The Seed island concept, which is being proposed in this LMP, is outlined and detailed further in **Appendix I: Section 4- Seed islands and Riparian corridors and Appendix I: Section 5- Future Woodland-Vision for the future. For detailed information see the Operational delivery plan Document# 3, Appendix XXIII: Future Woodland (Example delivery phases).** This should be referred to in conjunction to the information which is presented below.

The accompanying maps **Reference: M14.0-Natural Regeneration survey category,** , illustrate in a broad zonation areas of the catchment which have regeneration present or none at all. This is further detailed and analysed in **M14.1 - Natural Regeneration Analysis.**



From the natural regeneration survey a natural boundary line can be observed between Categories #1 and #2. This change between the categories, although delineated at a large scale, represents the upper limits for which natural regeneration, at current, is able to advance from its seed source and establish on site.

As the main seed source for natural regeneration comes from the lower elevations, the limit of this seed to spread into the mid to upper elevations is impacted by three main factors;

1. **Seed dispersal:** The ability of seed to disperse into the upper elevations on the wind and or be distributed by other vectors (i.e. bird distribution; such as with Rowan berries).
2. **Herbivore impacts:** In the upper elevation, the presence and movement of herbivores is higher, with associated impacts from browsing.
3. **Site conditions:** The soil and microclimate conditions have been impacted by historical land use, which will impact on tree establishment.

Category (reference map M14.0)	Description
CAT #1	No Regeneration present <50 stems/ha
Category (reference map M14.0)	Description
CAT #2	Regeneration present (50-399 stems/ha + <0.4m height)
CAT #3	Regeneration present (>400 stems/ha + >0.4m height)
CAT #4	Regeneration present (>500 stems/ha + >1.5m height)

Table 10: Natural Regeneration Survey Categories

Woodland creation proposals, as outlined below, detail a methodology which is designed to encourage natural regeneration within the upper elevations, Category zone #1 in particular, as well as Category zone #2. The creation of future seed sources in the mid to upper elevations is aimed at promoting a natural development and spread of seed, once the herbivore impacts can be reduced and also maintained at sustainable level to facilitate tree regeneration..

7.1.2 'Seed Island Zone' & Riparian Planting proposals-Forest Research

The accompanying maps **Reference: M15 -Watercourse & Riparian planting, M18 - Future habitats & species**, illustrates the species distribution with regards the planting mix prescriptions, as detailed below. **M16.2 – Golden Eagle considerations with planting**, details the special considerations attributed to planting within Golden eagle areas.

Forest Research study: Recommendations for tree species, species mixtures and spacings are based on Forest Research (FR) establishment experience and experiments, especially at higher elevations such as with the analysis of the FR Gisburn 3 experiment. This experiment was an attempt to establish a new native woodland dominated by birch and sessile oak, with other native broadleaved species, in a deer



fenced enclosure at an elevation of 320-360m, on a felled Sitka spruce site in the Forest of Bowland in Lancashire. This site is exposed with a DAMS of 17 and little topographic shelter.

It was found that after 15 years of establishment an average tree height was between 1-2m, depending on the species. Thus demonstrating the long-term nature of projects involved at a higher elevations. The experience from the Gisburn experiment, as well as other FR studies and FLS woodland creation projects (such as the Rest and Be Thankful), indicate that in a site with exposed conditions, at higher elevation, it is important to establish pioneer tree species first. After which other species can then be incorporated, up to 20 years later. From this FR experiment, a recommendation of downy birch /rowan mix as the main component, with alder/aspen mix in wetter locations (birch 60%, rowan 20%, alder and aspen c. 10% total) was prescribed.

Other minor species could also be incorporated initially, as a small component (c. 10% total), but may increase over time by self-seeding or could be encouraged through planting when more shelter has been provided. Oak would also be used in vulnerable patches, such as at heads of gullies or landslip areas, in a mixture with birch (or other appropriate species), and would benefit from protection in small tubes to aid establishment. Willow species should be established in gullies wherever possible. In landslip areas a recommended tree spacing of 2.0 m across, with 1.5 m spacing in the most vulnerable locations at the head of gullies. Areas with rankers, rock or soil depth of < 20 cm should be left unplanted with the aim that they would seed naturally.

This LMP will focus on establishing pioneer species, through the establishment of seed islands , which will facilitate future woodland expansion through natural regeneration.

The table below indicates the species most suited to each soil type and the associated Woodland type:-

NVC Woodland Type	W4	W7	W11	W17	W18
NVC Description	Downy birch - Purple moor grass	Alder-ash-yellow pimpernel	Sessile oak- downy birch- wood sorrel	Sessile oak- downy birch - moss	Pinewood
Soil Type	Acid peats and peaty gleys	Flushed mineral gleys and gleyed brown earths	Acid brown earths (low base status)	Podzols, ironpans, podzolic brown earths	Podzols, ironpans, peaty ironpans

Table 11: NVC woodland associated with soil type

Selection of the below species and mixtures have been made with consideration of the above as well as the local climate data via the (ESC) Ecological Site Classification Decision Support Tool. A further consideration for the establishment of woodland in many of the upland regions relates to the site history. Prolonged and intensive land management through grazing and burning have degraded soils.



With this site history and management regime there is a strong rationale to approach woodland creation in these areas with the use of a pioneer species so as to recover/restore soil and microsite conditions. In the upland areas the use of rowan, common alder, birch and Scots pine is recommended. These pioneer species will serve a critical role in improving soil PH and organic matter, both in nutrient and moisture content, and improving organic recycling. Increasing the potential to encourage and develop worm activity as well as mycorrhizal/fungi forming relationships. Over time these pioneer species will help to change the microclimate which will serve to benefit further natural regeneration, for species currently found within the ASNW and in the current species mix prescriptions. This will then pave the way for a continued development and recruitment for a variety of species and canopy structures, so as to form a dynamic and ever changing woodland structure well into the future.

At higher elevations birch can be prone to bacterial canker, although this is predominately a fungal pathogen, site factors and provenance selection can contribute to stressing trees; thereby increasing the risk and chance of infection. In the lower elevations of the catchment this is already showing in the silver and downy birch **Reference Appendix XXVIII – Future Woodland development, Section ‘Species selection’**.

The use of Scot Pine in some areas of the catchment in the mid to upper elevations (400m+), will be of benefit to the establishment of broadleaved species in both protection and microsite development. At these elevations the Scots pine will form a stunted and twisted form. However, establishing this scrub tree form will serve to attract bird wildlife increasing the chance of further rowan regeneration through natural vectors. It also provides a pioneer tree cover, pending a failure of birch to establish as a result genetic and or an establishment failure of birch as a result of bacterial canker.

The species mixtures as described below may be subject to further enrichment during beat-up phases, with species that fulfil the objectives and prescriptions of each area and are suitable to changing site conditions, such as increasing local shelter from establishing surrounding crop. It is important to design such an element of species flexibility into new planting with upland soils as localised variations in texture and nutrient availability may become more apparent in time. Such flexibility falls within the parameters detailed in the LMP Tolerance Table in **detailed in LMP**

Document #4 Scottish Forestry, Section B: Tolerance table

Planting prescription	Local site type	Species	Target Density (Stems/ha)	Design
Native Mixed broadleaf (NVC-W17)	Mineral moraine knolls	Downy birch, rowan, hawthorn, common alder, hazel. Occasional Scots pine, aspen, sessile oak, holly	600	Blocky mix, directed by micro-site suitability. 2.5 x 2.5 m tree spacing. 50% open
Native wet woodland (NVC-W4 & W7)	Riparian and wet ground, locally sheltered	Common alder, downy birch, willow (grey, goat). Occasional hawthorn, rowan, hazel on drier spots	600	2.5 x 2.5 m tree spacing. 50% open



Planting prescription	Local site type	Species	Target Density (Stems/ha)	Design
Native shrubs	Gleys & brown earth, locally sheltered	Hazel, hawthorn, willow, blackthorn, Native crab apple, holly	400	Interlaced with designed open space to maintain views (2.5 x 2.5m tree spacing, 50% open

Table 12: Loch Katrine Overall planting prescriptions.

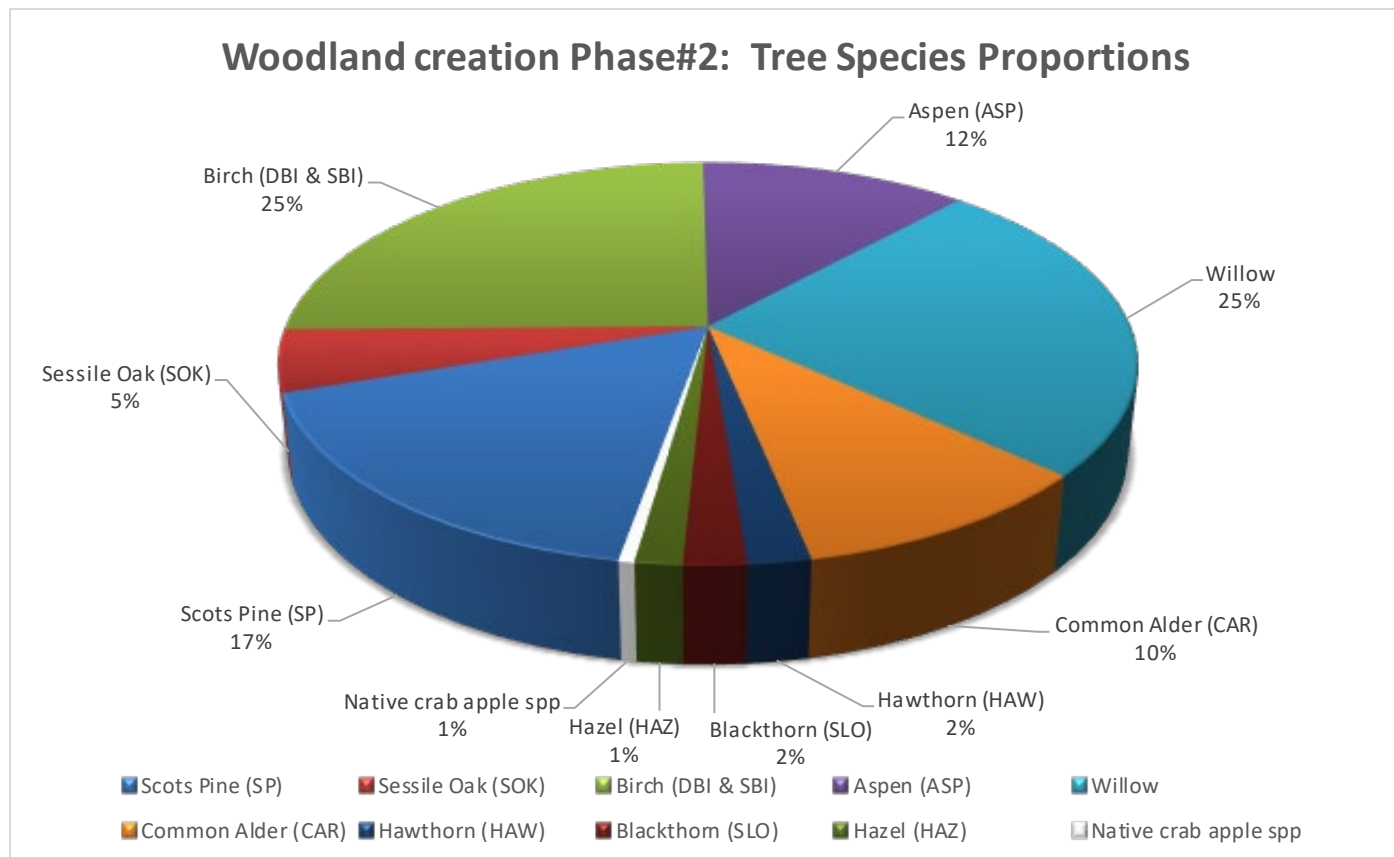


Figure 4: Phase #2 - Tree species proportions (New woodland creation areas-Seed islands)

New Planting (Seed islands)

Zone	Establishment method & Species The main species component has been highlighted in bold)	Comment
Low to Mid elevation (200-350m)	Create enclosure in an advanced Rowan or birch regeneration areas. Sessile Oak, Downy birch , Aspen & Willow spp -Rowan regeneration is likely to occur, so will be accepted.	The use of Gorse (<i>Ulex europaeus</i>) and broom (<i>Cytisus scoparius</i>) will also be considered in areas. This thorn scrub will be beneficial to regeneration as well as for invertebrates and bird life.



Zone	Establishment method & Species The main species component has been highlighted in bold)	Comment
Mid to Upper elevation (400-550m)	<p>Create small enclosures on areas which have been ground-truthed to show advanced Rowan regeneration, currently being browsed. These are location which are on mineral soils (Mainly Moraine knolls) and avoid any peat areas (>40cm). Addition of other species to allow for a more diverse seed source to develop in association with Rowan.</p> <p>Downy birch, Scots Pine, Aspen & Willow spp -Rowan regeneration is likely to occur, so will be accepted.</p>	The protection of this advanced rowan regeneration will allow for these suppressed trees to quickly establish and grow in height within a couple of growing seasons. This will create cover for planted trees (supplementary species added for species diversity) to establish with some cover.
Upper elevation (600+)	<p>Create small to individual exclosures in an area with advanced rowan & or willow regeneration. Locate on slopes with mineral soils and avoid peat (>40cm peat). Select locations which provide a degree of shelter, rick bluffs, from the prevailing wind.</p> <p>Willow species (spp) -Rowan regeneration is likely to occur, so will be accepted.</p>	

Table 13: Seed islands prescription

Phase	Establishment method & Species The main species component has been highlighted in bold)	Comment
Phase #1- Riparian planting SFA/HLF Project	<p>Common Alder, Downy birch & Hazel -Rowan regeneration is likely to occur, so will be accepted.</p>	<p>Planting of alder in areas next to the reservoir (Loch Arklet and Loch Katrine) will provide a natural netting to stabilise and capture any sediment coming down from the watercourse further up. For areas such as Loch Arklet, which have visual implications, the tree planting will only take place within the riparian corridor and not outwith this buffer.</p> <p>The use of Gorse (<i>Ulex europaeus</i>) and broom (<i>Cytisus scoparius</i>) will also be considered in areas. This thorn scrub will be beneficial to regeneration as well as for invertebrates and bird life.</p>
Phase #2- Riparian planting (FLS & Scottish Water)	<p>Common alder, Goat willow and Downy birch -Lower elevations: CAR/DBI/WILLOW -Mid elevations: CAR/Bi/ASP/SOK/HAZ -Upper elevations: WILLOW/Bi/CAR & HAW/SLO -Overhead powerlines at Glen Gyle: Within the OHPL corridor FLS will seek guidance from SPEN on some of the riparian gullies. These areas could be planted with scrub (Hawthorn/Blackthorn and willows), to aid with riparian bank stability and erosion, without effecting the infrastructure access. -Rowan regeneration is likely to occur, so will be accepted.</p>	<p>Eagle territories will avoid planting within the proximity of the nesting area. There will be a buffer zone applied of 100m around the nest site and no planting will be undertaken within (only with guidance from environmental advice). If planting is undertaken this will be shrub/scrub.</p> <p>The use of Gorse (<i>Ulex europaeus</i>) and broom (<i>Cytisus scoparius</i>) will also be considered in areas. This thorn scrub will be beneficial to regeneration as well as for invertebrates and bird life.</p>



Phase	Establishment method & Species The main species component has been highlighted in bold)	Comment
Phase #2.1 (Peatland riparian planting)	Goat -Upper elevations: WILLOW/Bi/CAR & HAW/SLO -Rowan regeneration is likely to occur, so will be accepted.	Many of the burns which extend up into the peatland areas have a mineral banking, contained within the riparian corridor. The planting will be focused in these areas, avoiding the planting of trees within deep peat.

Table 14: Riparian Planting prescription

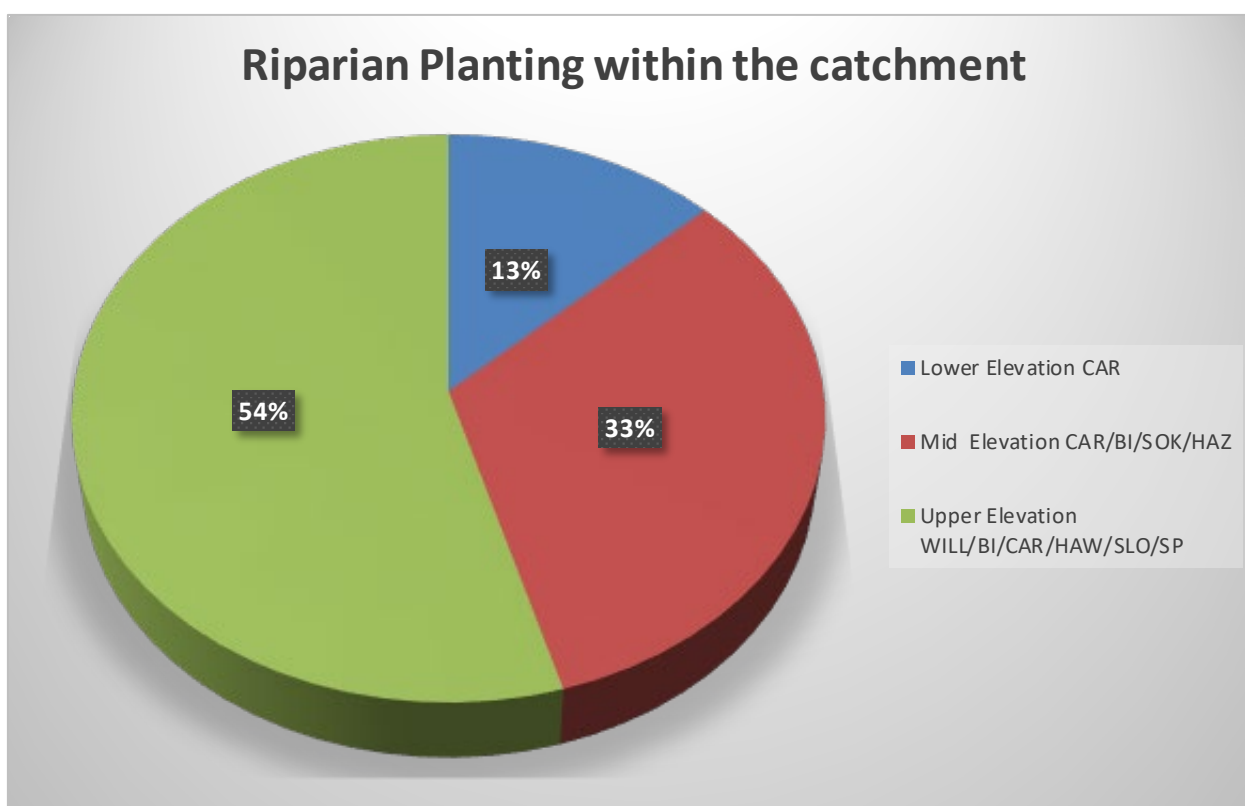


Figure 5: Riparian Corridors – Planting elevations with species

As illustrated in the chart above, in **Figure 7**, most of the riparian planting will be focused in the mid to upper elevations. **Reference: M15 -Watercourse-Riparian corridor and Appendix I - Section 4.2 Riparian corridors. LMP Operational delivery document #3, Appendix XXVIII – Future Woodland development, Section-Riparian corridors.**

7.1.3 Ground preparation

The use of mechanised ground preparation will be avoided in this phase of the woodland creation in the upper elevations, given the risk of hydrocarbon leakage into to the water supply. However, the option for invert mounding in a very small area of the catchment should be considered, located within the mid-elevation, although it is unlikely to be implemented. Hand screefing will be the main method of ground preparation employed, as the primary form of ground disturbance, associated with tree planting operations for woodland creation.



However, for the PAWS harvesting areas, FLS would retain the option to undertake some form of ground preparation within the restocking areas. The use of hand screefing, with direct hand planting will be employed, wherever possible, and will be the preferred option. However, pending the condition of the restock site, post harvesting, the movement of brash etc maybe required. Brash raking would also be advantageous to create a disturbed/mineral seed bed to increase the chance for natural regeneration. However, this option will require a balanced approach against the benefits, as noted above, against the risk of machinery use within the catchment and movement of soil, releasing carbon into the atmosphere.

Forestry and Land Scotland comply with current industry best practice guidelines (e.g. Forest and water guidelines) and UKFS stipulations in order to protect water quality throughout all forest operations.

7.1.4 Crop protection

The use of deer fencing and individual tree protection will be employed to protect trees from herbivore damage. This will take the form of small deer fenced exclosures, around seed islands, which will range in size from 1ha to 4 ha, or as smaller groups i.e. 10m x 10m or individual trees.

Seed Island fencing: Fencing design is critical for effective deer management and to allow the movement of animals through the landscape in a natural way to access riparian zones etc **Reference: LMP Scottish Forestry Section 0.8 Proposed fencing-Brief landscape and visual assessment.** Careful positioning of exclosures can also avoid the desire or need for hill walkers to enter within an exclosure, thereby maintaining security and protection of the trees within. It also helps to remove the risk of wildlife getting trapped, or finding a way into a fenced area for browsing or cover. **All fencing will have grouse marking.**

Therefore each exclosure will be designed by the operations team, with the involvement of the wildlife and planning team to ensure the design will function best for operational delivery as well as to ensure public and or wildlife obstructions are avoided. Detailed further with images in **LMP Document# 3 Operational delivery plan, Appendix XXVIII-Future Woodland development-crop protection, seed islands and riparian planting zones.**

Riparian corridors : The stabilisation of riparian corridors is key to reducing the impacts of sedimentation and further erosion of the river banks. This will also slow the speed of water moving along these channels to potentially help mitigate against landslides and other extreme weathering events.

Due to the nature of the watercourses and their requirement for access, for wildlife and people, the use of a variety of protection measures will be considered/employed for the establishment of trees within this challenging zone. This will take the form of the following;

1. **Individual tree protection:** This will be a low gauge metal netting, or the re-using of old rylock netting form stock fence on site, which will be wrapped around the tree and secured with a thick tree Stob.
2. **Group protection:** Small exclosures, commonly found in parklands or estates used to establish standard trees will be employed. This will employ an 'easy-to-construct' method balanced with durability to protect and last against the elements. It will employ 4 deer posts with a rylock netting, most likely a two piece



(utilizing old rylock fencing rolls found on site) or new rolls which are easier for logistical movement on site.

3. Seed Island protection: LMP Document# 3 Operational delivery plan, Appendix XXVIII-Future Woodland development-crop protection, seed islands and riparian planting zones. A standard deer fence (red specification), two piece rylock. The size of the enclosure can range from a 10m x 10m to a 20m x 20m, up to a slightly larger area of between a 1ha-4ha. The design of the small enclosures will be specific to the location, to allow the movement of animals through the landscape. Therefore they will not take the form of an conventional ring fence enclosure, which forms a long barrier, square or rectangle appearance.

7.1.5 Use of Chemical and Fertiliser

No chemical pesticide or insecticide will be used in the catchment with regards to woodland creation, in the management of weeds and or insect protection.

Non-invasive plant species control (Rhododendron): The use of eco-plugs may be used for a targeted application to control the spread of Rhododendron within the catchment.

Fertilizer will be applied where required and with the strict guidance and approval from Scottish Water. Granular or ground rock Phosphate or PK (0:20:20) would be applied by hand, to individual trees, post planting in the ground. For most areas this will not be required and will be actively avoided. No fertiliser will be applied to riparian planting zone areas. A minimum buffer of 100m will be applied from any water feature or burn.

Forestry and Land Scotland comply with current industry best practice guidelines (e.g. Forest and water guidelines) and UKFS stipulations in order to protect water quality throughout all forest operations.

7.1.6 Deer management

As with all FLS deer management programmes, deer management at Loch Katrine will be guided by a Region specific Deer Management Strategy, which is underpinned by a national code of practice and industry best practice guidelines.

An operational strategy for protection of the new planting and restock at Loch Katrine will be informed by on-site deer population monitoring and Herbivore Impact Assessment (HIA). Additional considerations such as tree species palatability, local topography and other operational constraints will be taken into account. In practice a combination of tactics will be implemented, including deer management, tree tubes and fencing across the site.

The latest analysis suggests that deer populations are still high at an average of 7-19/km²., with a residential population of roe and a transitional herd of red deer, which are moving through the landscape from the north. Therefore, although the preferred approach is to manage the background deer numbers through culling, (bringing numbers down to a sustainable population where browsing



damage is at an acceptable level), because of the current density of deer fencing will be considered as an option.

In order to aid safe, efficient and humane deer management operations, a consideration of sufficient backdrops and access for extraction will be incorporated into the design of fencing and planting.

7.2 Biodiversity and environment

7.2.1 Flood management

N/A

7.2.2 Water bodies and Riparian zones

Loch Katrine and Loch Arklet with associated minor lochs/lochan's and ponds, within the catchment, feed into the main reservoir of Loch Katrine; which forms a strategic water supply for the central region of Scotland.

The riparian zones found throughout the catchment (reference watercourse map), are numerous and intricate, forming an network of tributaries and burns which connect all parts of the land and hills to the loch below. A removal of tree cover and draining of the land, combined with high herbivore browsing, has increased the erosion of sediment and peatlands within the network of burns.

Many of the riparian corridors which extend up into the peatland habitat have exposures of peat and mineral/bedrock which are showing signs of erosion, which would naturally have some form of vegetative cover either through stunted trees or shrub. This natural cover would help to mitigate against the gradual erosion of any exposed soil. In cases of extreme down pour events, such as in 2019 a 1/100 year event, a vegetative canopy could have helped to reduce the scouring within the burns and also help to protect any exposed surfaces.

It is therefore proposed that the associated riparian areas will be established with mixed native broadleaf woodland. Trees will be arranged to incorporate some open space to maximise habitat provision, as described further **Appendix I - Section 4.2: Riparian corridors & protection**, detailed further with images in **LMP Document# 3 Operational delivery plan, Appendix XXVIII-Future Woodland development-crop protection, seed islands and riparian planting zones**. Once established, the riparian woodland managed under minimum intervention, will act as a natural buffer zone for the watercourse, developing over time through natural regeneration.

Forestry and Land Scotland comply with current industry best practice guidelines (e.g. Forest and water guidelines) and UKFS stipulations in order to protect water quality throughout all forest operations.

7.2.3 Priority Habitat & Species



Priority open habitats Priority Habitat and species are protected under the UK biodiversity Action Plan (UKBAP). FLS policy notes this and aims to protect, enhance and expand these habitats where appropriate. There are a broad range of habitat and species types within the plan area, outlined in **detailed in Appendix I – Section 3.4.1 Priority Habitat and species.**

An independent Open Habitat survey along with breeding birds and golden eagle report survey was commissioned by FLS in 2021. Data from the survey has been reviewed by the FLS environmental team, complimented with FLS peatland team and environmental teams experience. Long term co-operation with the raptor group, regarding ornithological interests, as well as the commission of an external contractor have provided comprehensive data on the catchment. The results are **detailed in Appendix X - Priority Open Habitat and Woodland Creation Report (LUC-2022), Reference: M13: Open habitat survey(LUC)**

7.2.4 Deadwood

The coniferous plantations located on PAWS sites within the catchment have windblow pockets and areas which are inaccessible to fell trees safely. Therefore a retention of windblown stems, both fallen and or snapped, as well as to kill tree standing by stem injection provides opportunities for deadwood. This can help to retain areas within the catchment which form a mixture of deadwood habitat through fallen, standing or stacked deadwood. Areas will be monitored throughout the LMP via periodic tree surveys.

7.2.5 Invasive species

- **Grey Squirrel (*Sciurus carolinensis*):** Grey squirrels have been present in the catchment in the past. However, an increase in pine martins (*Martes martes*), in the area has served to displace and remove individual populations out with the catchment area.
- **Rhododendron (*Rhododendron ponticum*):** Rhododendron is a non-native plant which is located on many of the private residential properties within the catchment. LLTNP and FLS are working with neighbouring landowners to remove this species and to replace with a native or non-aggressive ornamental rhododendron alternative. As this plant species harbours the P.ramorum disease and is also aggressive in its spread and domination, removing native vegetation; its control is paramount within this NNR.
- **Sitka spruce (*Picea sitchensis*):** Loch Katrine is a NNR with ASNW, with the aspiration to create native woodland, predominately broadleaved, with wetlands and peatland areas. Due to the nature of Sitka spruce and its plasticity for a range of conditions and ability to tolerate wet conditions Sitka has the ability to colonize areas readily and quickly given a nearby seed source. The PAWS clearfelling of WGS coniferous plantations, is paramount to removing a future seed source for the catchment, as is the removal of any trees which have seeded out form the blocks further into the catchment.

7.2.6 Important species

The variety of species listed in **Appendix I – Section 3.4.3 other notable species** shows the range and diversity of both flora and fauna within the catchment. The management proposals outlined in this LMP are focused on developing habitats but allowing them to progress through a natural processes of



succession. This gradual approach will allow species to adapt over time as well as to develop a structural diversity at different elevations. The restoration of peatland areas, improving riparian corridors and woodland creation at higher elevations will create corridors and form a mosaic of habitats to increase the biodiversity within the catchment.

7.2.7 Landscape

Reference: Appendix VII- (LVRDR report & LVRDR Appendix)

CSA Environmental have been appointed by Forestry and Land Scotland to undertake a Landscape and Visual Review and Design Response to support the preparation of a new Land Management Plan for the Loch Katrine Forest Block. The proposals are for ongoing native woodland creation, peatland restoration and related management activities across the land which forms the catchments for Loch Katrine and Loch Arklet within the Loch Lomond and Trossachs National Park. The long-term aspiration for this area and informing these proposals is continued landscape restoration and the establishment of a healthy, functional and self-sustaining ecosystem within the catchment.

The report was undertaken in three stages. The first element was Landscape and Visual Review, which assessed how the landscape of Loch Katrine has changed and collation of relevant policy and guidance published since the previous assessment in 2007. While large parts of the area have been planted with new native woodland, in the intervening years landscape change has generally been subtle, with a more obvious influence on the landscape character found in areas where the landscape scale is smaller, such as at Glen Gyle. The majority of the new planting has assimilated well into the landscape and natural regeneration of native woodland is further contributing to the landscape character of the area. The previous Forest Design Plan proposed felling of areas of introduced conifer plantation which did not take place. The retained conifer can be seen as a detractor to the landscape character in this context. Recent landslips and the associated hard infrastructure works in response to them have also impacted on the experience of the landscape, particularly from the loch shore road around Loch Katrine.

The Landscape and Visual Review concluded with a set of general and specific recommendations for the development of the Landscape Management Plan proposals. From this, the second stage of the assessment involved an iterative process which was undertaken with the FLS team to incorporate landscape and visual considerations into the proposals, balancing them with the range of other factors relevant to high quality land management practice.

The third stage comprised the *design response* which was prepared following the completion of the proposals, in order to assess how they have responded to the recommendations set out in the *Landscape and Visual Review* and the additional guidance provided through the iterative design process. The proposals have taken into consideration the recommendations to include appropriate species and densities for new planting in order to enhance the landscape character across the area, maintaining key open views, and the removal of introduced conifer within the LMP area to allow the restoration of native woodland. Overall, the proposals should result in beneficial landscape and visual effects.



7.2.8 Peatland restoration and carbon sequestration

Reference: M12 Peatland Restoration.

This plan proposes to undertake peatland restoration, as a collaboration between Scottish Water and FLS, within a gross area of 625 Ha. This area is sub-divided further into 69 Ha of peatland restoration (involving both drain blocking/hag reprofiling) which links into the neighbouring landownership. An initial desk based survey has identified an area of approximately 135 ha of potential hag reprofiling, with a further 421 ha of potential drain blocking designed to re-wet the peatland system. **Reference: M12 Peatland Restoration.**

Further detailed surveying will be required to assess the actual net area for potential restoration. This is likely to be substantially less and requires balancing with the viability for operational delivery and access. Scottish Water are seeking to undertake a feasibility survey, contracting an independent consultant. Results from this survey planning portal for the Permitted Development Right (PDR).

Site Description

The peatland on the hillslopes within the Katrine block consists predominantly of blanket bog and upland heath. The condition of the blanket bog is variable with the significant areas of extensive peat hags, pans and active erosion. The exposed landscape of Katrine will prevent the natural recovery of the exposed peat, therefore restoration will be undertaken. Re-wetting the site will benefit the peat soils, stopping oxidation and further degradation and erosion. This will reduce greenhouse gas (GHGs) emissions and improve the water quality of the local area by reducing run-off from the peatland. Overall, the goal at Katrine is to create a hydrologically functioning blanket bog-upland heath complex.

Restoration Proposal

Due to the extensive nature of the Katrine, several walkovers across the site were conducted by the local planning and peatland teams. The walkovers were to establish the condition of the peatland, level of water table, vegetation indicator species, and connectivity and extent of the peat. The walkover identified the main threats to the peatland habitat and the feasibility of restoration, confirming that full restoration will be possible. The findings were as follows:

- The extent and distribution of the blanket bog and deep peat was variable with areas of deep (>50 cm) and shallow (<50 cm) peat. Peat hags, bare peat and active erosion was evident across the landscape and identified as the main threat to further habitat degradation.
- The site has been historically drained. The majority of field drains consist of deep eroded channels and eroding sides, suggesting that substantial amounts of water is still being carried in these drains. These will not naturally revegetate, therefore blocking these drains along with additional rewetting works further uphill will need to be undertaken to slow the flow and hold water within the peatland catchment.
- Due to the historic drainage channels and subsequent drying and contraction of the peat, small peat slides were observed.
- The water table was at the base of the field drains where these were present. Several peat pipes were found which will need to be taken into account during pre-operational site planning.
- There is sufficient existing seed source of sphagnum and other bog species on site to make this successful. Suitable donor sites for the hag re-profiling and bare peat pan re-vegetation will be identified.



A combination of standard re-wetting techniques will be used to re-instate the natural water table across the site to ensure it is optimal for appropriate bog vegetation recovery. A combination of drain blocking, hag re-profiling and bare peat re-vegetation, will be used following techniques as developed by Nature Scot (Peatland Action Fund) and FLS. FLS have a long-term commitment to the Scottish Government to reduce GHGs across the National Forest Estate and the re-wetting will be funded through the Scottish Government Climate Crisis Fund.

In conclusion, the restoration of this site will be feasible using tested restoration techniques. Further surveys will be undertaken to establish a detailed restoration plan for the purpose of, and to meet the requirements for, the funding application. These surveys will be ongoing due to the size and nature of the site. The delivery of re-wetting operations will be undertaken within the plan period and in line with the UKFS and UKWAS standards. Monitoring of the site (vegetation quadrats) will take place at year 5 following re-wetting.

Peatland restoration

Exposures of peat on slopes, termed 'Peat hags', present an opportunity for intervention to restore and protect the exposure so as to prevent erosion of the peat and or degrading through decomposition which releases carbon into the atmosphere. Peat hags can form naturally and slumps or movement within the peatland habitat can be a normal process, along with peat pipes. Many peat hag exposures are believed to have formed in the mini ice age, in a period of natural cooling, which fractured the peatland and opened many of the peat faces. Exposures of peat can recover through a process of collapse and revegetation. However, in an environment which has high level of herbivore browsing and or poaching of the surface, the exposures can be perpetuated. Therefore maintained as an open and exposed surface, the peat is unable to re-vegetate therefore vulnerable to erosion and drying out, which accelerates the decomposition of peat, which releases carbon into the atmosphere.

Wetlands: A re-wetting of the peatland habitat

Historically peatland has been drained by man through a series of hand cut drains. Many of these can be easily found on the ground and or viewed aurally with photography and or on maps. Much of these hand dug ditches were originally quite shallow and numerous throughout the landscape, designed to drain the excess water from the wetland, to promote the abundance of grass for grazing animals. Over the years the ditches have increased in depth due to erosion, creating very deep channels which expand wider over time. Peat is a very erodible material and as many of drains were focused on getting water away quickly as possible, the drains follow steep angles and in many cases are directed into watercourses.

The blocking of these deep ditches, by means of installing dams and or natural blocking methods can help to re-wet areas of peatland and reduce this erosion.

H10/12 Heathland and acid grassland. A justification for woodland creation, natural and direct intervention

The UPLAND HEATH, priority open habitat contained in the Biodiversity list as defined by the Nature conservation Scotland (2004) Act, includes priority open habitats such as upland heath, upland flush, fen



and swamp, and blanket bog. FLS, as a public Body, has a biodiversity duty to protect and enhance priority habitats. Upland heath in some circumstances, have the biodiversity value and function improved by establishing native woodland scrub. Upland heath habitats in Scotland are regarded by many ecologists as a degraded habitat, when denuded of all woodland or tree cover, and would natural have had some form of fragmented tree cover, albeit a sparse mosaic and mixture of broadleaved trees; either isolated or patchy clumps. It is proposed that woodland creation is undertaken throughout the catchment by active planting and or through the protection of natural regeneration. The focus of this establishment will be to improve biodiversity networks as well as to improve the function of the hydrological units to prevent further erosion of the peat and or mineral soils within the riparian corridors or upland areas.

Woodland cover will form as a mosaic of tree cover, which will take place on moraine deposits, of mineral /organic mineral composition. Tree cover focused on the hummocky terrain, as well as through riparian corridors i.e. burns, which will create an environment that will enhance various habitats. A number of birds species within the catchment will benefit from this additional tree cover either through further food source for young chicks and or additional prey. It will also mitigate against further surface water erosion and reduce the effects of summer droughts. This will help to stabilise the water levels within the hydrological units as well as in the lower lying areas such as the loch. In peak flows periods, this will potentially reduce sedimentation and mitigate against erosion and high volumes of water which is moving through the peatland areas, which can affect the water quality and treatment process.

Native woodland associated to the open habitat will provide a favourable shelter edge, serving to reduce the exposure of sun and wind, helping to mitigate against spring and summer droughts.

7.2.9 Designated sites

The National Scenic Area (NSA), Loch Lomond and the Trossachs National Park and Special Area of Conservation and Site of Special Scientific Interest acknowledge the link between high quality landscape and habitat, which defines the Trossachs, and makes it a popular destination.

As illustrated in the 'Final Concept' map, **Reference: M4, Final Concept** the Loch Katrine Site of Special Scientific Interest (SSSI) and Special Protection Area (SAC), are located towards the Trossachs pier east boundary. The upland hills are noted for their resident Golden eagles and breeding birds.

In preparation of this plan a breeding bird survey was conducted at Loch Katrine. The results are detailed in **Appendix IX**.

The local FLS planning team and in-house landscape architects have worked together to ensure that the new woodland design is in-keeping with and complimenting the local landscape. This has involved joint site visits, landscape forces assessment and scenario testing via visualisation software. The attached Planting map **Reference: M16.0 – M17.2**, as well as landscape visualisations **Reference: Appendix VII**, illustrate the design outcomes which complement the landscape variables, in terms of scale and visual complexity.



As illustrated, the new woodland will be characterised by high proportions of native broadleaf, native shrub species and open areas in the higher elevations relating to priority open habitat. The landscape visualisations illustrate the key viewpoints that have been considered in the design and how these will be enhanced by woodland creation on site.

Tree felling in designated areas will be undertaken only for safety reasons as per **Section 7.1.5 Other Tree Felling in Exceptional Circumstances**.

7.3 Heritage

The heritage features on site will be protected through our standard operational procedures described in **Appendix I - Section 3.5 Heritage and Appendix XIV-Archaeological report**. At Loch Katrine and Loch Arklet this will entail assessment and flagging of operational buffers around heritage features during establishment operations, to avoid disturbance particularly by ground preparation machinery.

Furthermore, to maintain and enhance the sense of place associated with the catchment, particular care has been taken to ensure that visual and pedestrian links between the heritage sites are maintained.

7.3.1 Non-Scheduled Archaeology

There are a number of features throughout the catchment. Appropriate buffers will be applied and maintained around non-scheduled archaeological features so as to ensure that trees. All operations in the vicinity of such features will be conducted in accordance with the UK forest standard guidelines on Forest and the Historic Environment, applying suitable controls to ensure their protection.

7.4 Operational access

Loch Katrine has two main entrances into the catchment, which form a ring road and take the form of public and private roads. To the west, the B829 Lochard road, from Aberfoyle, takes you into the catchment above Loch Arklet, which if followed on the north shore gives you the option to travel further west to Loch Lomond, at Inversaid, or east to the Stronachlachar Pier. To the east the other main link into Loch Katrine, via the Trossachs pier, runs as a private tar road which connect to the Stronachlachar pier, passing Glen Gyle in the north.

7.4.1 Forest Roads

Reference: Operational Delivery Plan #3-Appendix XXVI – PAWS Logistics: Movement of timber

A forestry road network can be found at a number of key locations within the catchment.

- At Glen Gyle, the Eve's road forms a join access route, which has been a historic drove road, upgraded from a 4x4 track by SPEN for the undertaking of OHPL construction.
- A private tar road, owned by Scottish Water, accesses the south side of Loch Katrine passing the Royal Cottage to end at Culligart. A forest 4x4 road then extends access along the south shore between Culligart and Glassahoile.
- At Brenachoile the forest road access the primrose forest block. An additional section of road has been proposed at Primrose Hill, where the east spur needs to be extended an additional



397m to allow harvesting equipment and lorries to access the standing timber. In addition a number of laybys may be required to allow harvesting equipment and timber to be brought adjacent to the tar road for harvesting operations to take place. Once a full assessment by the Operations Team has been undertaken the LMP will be updated, it is likely laybys and transfer points will be required at Stronachlachar, the Boathouse and the PAW's stand near the Silver Strand.

- The existing tracks at Glen Gyle, Eve's road and the 4x4 route from Culligart to Glassahoile will be maintained by FLS, as required. The main operation site access is gained directly from the Trossachs pier in the east of Loch Katrine, as well as from the Stronachlachar pier located in the west. The existing forest road network will be maintained, facilitating timber harvesting when required, such as with the primrose location. This road network will form the basis of the existing recreational path system, of which no further plans are intended in this LMP.

7.4.2 Quad access

FLS will form permanent cross country quad routes, so as to create a safe passage of quads, to facilitate long term management of the site. The routes will be marked out and exist as 'cross country' quad routes, currently used by the deer management team and if required low intervention hand digging will be undertaken in small sections, so as to make the route safe from side slopes or obstructions. **Reference: M6 - Access Overall.** The existing tracks at Glen Gyle, Eve's road and the 4x4 route from Culligart to Glassahoile will be maintained by FLS, as required.

7.4.3 Boat project-Harvesting operation

Reference: Operational Delivery Plan #3-AppendixXXVI – PAWS Logistics: Movement of timber

FLS require the construction of forwarding tracks to aid the use of a temporary pier at each of the harvesting PAWS sites; located at School House, Glen Gyle; as well as the Stronachlachar dry dock **Reference: M6.0 – M6.1-4 Access maps.** These floating piers are temporary mobile structures, or ramps, which are designed to facilitate the crossing of harvesting equipment from the shore line onto the barge. Which allows for safe movement of timber across the Loch.

A bathymetric survey will be undertaken to assess the underwater terrain. The barge designed for the movement of timber is currently being custom made with a unique design, with a low profile base, which may allow for beaching in certain locations, thereby avoiding the need for a floating pier to be used.

Reference: Operational Delivery Plan #3-AppendixXXVI – PAWS Logistics: Movement of timber

for images on the barge and boat system for moving timber harvested from the PAW's sites at School House and Glen Gyle. **Reference: Scottish Forestry 0.5.7: BOAT project Civil engineering.**

7.5 Management of Public Access

Reference Appendix I -Section 3.2.2 Access and Section-3.2.3 Operational access, Section 3.6.1 Recreation

Visitor Zones have been identified in areas where FLS encourage and manage access or where the woodland managed by FLS interacts with popular visitor sites or access routes, such as the north shore road which is used by cyclists and walkers **Reference: M9 Recreation & Access.** In these areas, single trees or small groups of trees will be removed when necessary to protect facilities, infrastructure and trails, or to enhance the setting of features, or to maintain existing views. Woodland in these zones will also be



thinned, or trees re-spaced, for safety reasons (including to increase visibility to ensure that sites are welcoming and feel safe) and where it is necessary to enhance the experience of the forest setting, through the development of large trees, or preferential removal of trees to favour a particular species.

As a partner with the Great Trossachs Forest Alliance, FLS continues to work closely with our neighbouring estates as well as maintaining the long distance walking route, starting from Callander and passing through the catchment all the way to the RSPB Inversaid estate, on the Loch Lomond shore. The previous FDP upgraded the Old military road, which negotiates the North shore of Loch Arklet. **Reference 3.6.1 Recreation (which details maintenance works undertaken in 2022).**

VIEW PROJECT: Reference- Section 7.3.6 VIEW Project-Screening hard infrastructure. Concept #6 (Artist Impression): Screening Infrastructure (OHPL) with tree planting. The **VIEW** project plans to create both walking paths from Stronachlachar to **Sophies island** (also known as Michelle's point), with the creation of a view platform and seating area to direct views of the Loch facing the Trossachs Pier. This is a project managed by Scottish Power Energy Network (SPEN), which is currently under review with the LLTNP authority. As this area of land comes under the FLS lease area, with Scottish Water as landowner, both parties will be involved in this planning process and seek to co-operate on this project. However; FLS will likely not have a direct involvement with the undertaking of the project operation.

FLS regional staff will continue to liaise with local neighbours, community groups and business on site to promote and encourage the use of the site. Community staff will continue to work constructively with the Loch Lomond and Trossachs National Park, as well as Scottish water and the Sir Walter Scott Steamship Trust.

8.0 Critical Success Factors

The critical success factors listed below relate to delivery against the management objectives listed in **Section 3**. They are:

- Protection the natural vegetation from the impacts of herbivores, through adequate deer control, to aid the recovery of the native habitats.
- Access works and forestry operations must be carefully planned and delivered to avoid sedimentation within the catchment
- Non-native species must be removed

2023 Loch Katrine Upland habitat



Potential Upland Habitat 50-100+ years





Forestry and
Land Scotland
Coilltearachd agus
Fearann Alba

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