Forestry and Land Scotland
Coilltearachd agus Fearann Alba

Land Management Plan

Greenburn

Forestry and Land Scotland

GREENBURN

Land Management Plan

Approval date: 11 JUL 2019

Plan Reference No: LMP 05-2018

Plan Approval Date: 11/7/2019

Plan Expiry Date: 11/7/2029

CSM 6 Appendix 1b

FOREST ENTERPRISE - Application for Land Management Plan Approvals in Scotland

Forest Enterprise - Property

Forest District:	Cowal & Trossachs
Woodland or property name:	Greenburn
Nearest town, village or locality:	Gartmore
OS Grid reference:	NS504937
Local Authority district/unitary Authority:	LLTNP and Stirling Council

Areas for approval

	Conifer	Broadleaf
Clear felling	84.6	
Selective felling		
Restocking	149.0	46.0
New planting (complete appendix 4)		

1. I apply for Land Management Plan approval for the property described above and in the enclosed Land Management Plan.

2. I apply for an opinion under the terms of the Environmental Impact Assessment (Forestry) (Scotland) Regulations 1999 for roads, tracks and quarries as detailed in my application.

3. I confirm that the initial scoping of the plan was carried out with FC staff on 13th April 2017.

4. I confirm that the proposals contained in this plan comply with the UK Forestry Standard.

5. I confirm that the scoping, carried out and documented in the Consultation Record attached, incorporated those stakeholders which the FC agreed must be included.

6. I confirm that consultation and scoping has been carried out with all relevant stakeholders over the content of the of the land management plan. Consideration of all of the issues raised by stakeholders has been included in the process of plan preparation and the outcome recorded on the attached consultation record. I confirm that we have informed all stakeholders about the extent to which we have been able to address their concerns and, where it has not been possible to fully address their concerns, we have reminded them of the opportunity to make further comment during the public consultation process.

7. I undertake to obtain any permissions necessary for the implementation of the approved Plan.

Signed ..... Signed pp .....

.Forest District Manager Conservator

District Cowal & Trossachs FD Conservancy Perth & Argyll

Date 24th July 2018 **Date of Approval** 11 JUL 2019

Date approval ends 11/7/29

Forestry Commission Scotland
Coimisean na Coilltearachd Alba

Environmental Impact Assessment
Screening Opinion Request Form

Please complete this form to find out if you need consent from Forestry Commission Scotland, under the **Forestry (Environmental Impact Assessment) (Scotland) Regulations 2017**, to carry out your proposed forestry project. Please refer to Schedule 2 Selection Criteria for Screening Forestry Projects under Applying for an opinion. If you are not sure about what information to include on this form please contact your local Conservancy office.

Proposed Work							
Please put a cross in the box to indicate the type of work you are proposing to carry out. Give the area in hectares and where appropriate the percentage of conifers and broadleaves							
Proposed Work	select	Area in hectares	% Conifer	% Broad-leaves	Proposed work	select	Area in hectares
Afforestation	☐				Forest roads	☒	2.2
Deforestation	☐				Forest quarry	☐	
Location of work							

Description of Forestry Project and Location
Provide details of the forestry project (size, design, use of natural resources such as soil, and the cumulative effect if relevant). Please attach map(s) showing the boundary of the proposed work and other known details.
See section 5.9 of LMP and relevant map

Provide details on the existing land use and the environmental sensitivity of the area that is likely to be affected by the forestry project.
These are described in section 3 the LMP.

Description of Likely Significant Effects
Provide details on any likely significant effects that the project will have on the environment (resulting from the project itself or the use of natural resources) and the

extent of the information available to assist you with this assessment.
Some tracks will be visible from summit of Ben Lomond. This has been assessed from site visit and analysis in GIS.

Include details of any consultees or stakeholders that you have contacted in order to make this assessment. Please include any relevant correspondence you have received from them.

Mitigation of Likely Significant Effects
If you believe there are likely significant effects that the project will have on the environment, provide information on the opportunities you have taken to mitigate these effects.
See section 5.9 and appendix VI of the LMP

Sensitive Areas	
Please indicate if any of the proposed forestry project is within a sensitive area. Choose the sensitive area from the drop down below and give the area of the proposal within it.	
Sensitive Area	Area
National Park (NP)	2.2ha
Select...	
Select...	
Select...	
Select...	

Property Details			
Property Name:	Greenburn		
Business Reference Number:		Main Location Code:	
Grid Reference: (e.g. NH 234 567)	NS504937	Nearest town or locality:	Gartmore
Local Authority:		LLTNP/Stirling Council	

Owner's Details			
Title:	Mr	Forename:	John
Surname:	Hair		
Organisation:	FES	Position:	Planning Manager
Primary Contact Number:	0300 067 6600	Alternative Contact Number:	
Email:			
Address:	FES		
Aberfoyle			
Postcode:	FK8 3UX	Country:	
Is this the correspondence address?		Yes	

Agent's Details			
Title:		Forename:	
Surname:			
Organisation:		Position:	
Primary Contact Number:		Alternative Contact Number:	
Email:			
Address:			
Postcode:		Country:	
Is this the correspondence address?		Select...	

Office Use Only	
GLS Ref number:	

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Summary of proposals and regulatory requirements

The Greenburn Land Management Plan (LMP) draws on the key themes of the Scottish Forestry Strategy (SFS) (2006), Forest Enterprise Scotland's Strategic Directions and Cowal & Trossachs Forest District's Strategic Plan.

The objectives of the new plan, which were developed following internal and external consultation, are summarised below and emphasise the key principals of maintaining the productive potential of the forest whilst delivering a range of other ecosystem services into the future.

1. In the longer term establish rotation lengths that improve resilience by diversifying age structure whilst aiming to maximise economic potential.

2. Continue to manage the forest for timber production, maximising potential by using Sitka spruce as the main species of choice.

3. Ensure the plan remains UKFS compliant by introducing a limited amount of diversity into productive areas where this does not significantly reduce volume production.

4. Use habitat networks to further increase diversity and improve resilience to wind damage.

5. Manage the upper forest edge to improve habitat for black grouse.

6. Create diverse woodland margins along major long distance recreation routes.

7. Afford adequate protection to Loch Katrine aqueducts and private water supplies during operations. Forest and water guidelines will be followed during forest operations. At restocking create adequate buffers along the routes of these facilities.

8. An appropriate deer management programme will be established to protect vulnerable planted stock and allow natural regeneration where this is the favoured method of establishment.

Proposed felling in years 2019 – 2029

Phase	Area (ha)	Volume (m^3)
1	28.2	10250
2	56.4	26270
	84.6	**36470**

Table 2.1 Summary of felling proposals

The roads and tracks map shows the coupes for which approval is being sought for clearfelling during the plan period. These are set in the context of longer term management proposals in the management map. The future habitats map should also be referred to.

Proposed thinning in years 2019 – 2029

Phase	Area (ha)	Volume (m^3)
1	72.3	3600
2	72.3	3600
	144.6	**7200**

Table 2.2 Summary of thinning proposals

Proposed thinning coupes are shown on the roads and tracks map and further detail found in section 5.1.1. Each coupe may be thinned twice in the plan period.

Proposed restocking in years 2019 – 2029

Phase	Species	Area (ha)
1/2	Conifer	149
1/2	Broadleaf	46
		195

Table 2.3 Summary of restocking proposals

Restocking proposals are shown on the future habitats map and further details found in section 5.2.

Where production is the key objective conifers will be planted at densities of approximately 2700 stems per hectare (sph) and broadleaves in the region of 3500. Target densities for native woodland regeneration will vary depending on site objectives but are expected to be in the range 200 to 1100 sph.

Where establishment is to be through natural regeneration its presence will be assessed five years after felling. If regeneration is not at desired levels a decision will be taken on whether to allow more time for natural establishment of trees or whether to take a more pro-active approach; for example, ground preparation to create a suitable substrate for seedling

establishment, or planting. Further evaluation will take place when the plan is reviewed at mid-term and ten years and future commitments to natural regeneration outlined in the mid-term review and plan revision.

Open areas will be allowed up to 20% tree cover. Sitka spruce regeneration will be kept within agreed tolerance limits on both open ground and in areas designated for broadleaved woodland. Small amounts of rhododendron are known to be present and appropriate measures to control this species will be put in place.

Access and roading in years 2019 – 2029

Phase	Type	Length (m)	Area (ha)
1/2	New roads	550	0.5
1/2	Tracks/ramps	7500	1.7
		8050	**2.2**

Table 2.4 Summary of roads and tracks

See also the roads and tracks map.

Departures from UKFS guidelines

There are no departures from UKFS guidelines.

1.0 Introduction:

1.1 Setting and context

The Greenburn Land Management Plan area is located midway between the small towns of Aberfoyle and Drymen. It lies on the northern fringes of a long ridge separating the Trossachs from Loch Lomond, at a point where this merges with the low lying ground of the Upper Forth Valley. Elevation ranges from approximately 40m to 240m and there are large areas of relatively flat ground. The plan area is divided by the unclassified "Old Drymen Road" and is connected to the main A81 trunk road by an access road at Hoish Farm. The western part is within the Loch Lomond and the Trossachs National Park, the eastern within the Stirling Council area. Rather than being marked by distinct physical features the boundaries are mainly legal and administrative. The area is surrounded by a mix of farmland, rough grazing and plantation forestry.

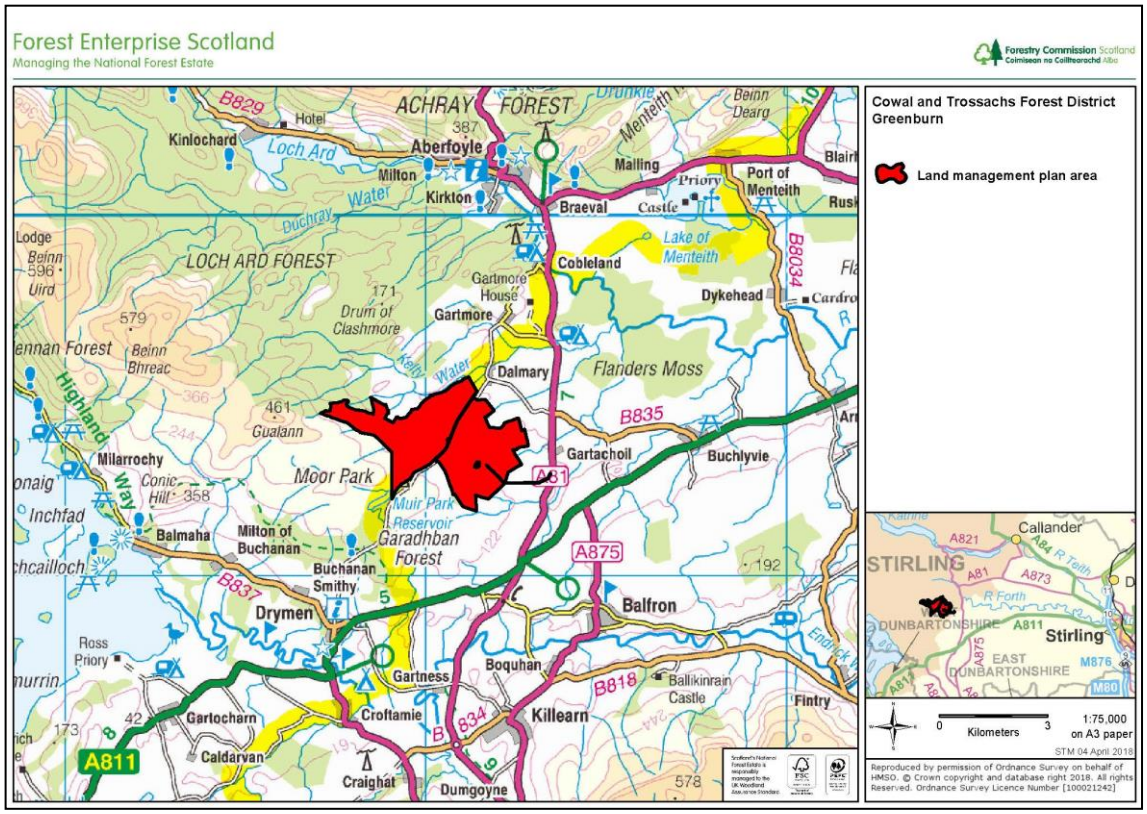

Figure 1.1 Greenburn: location

1.2 History of the plan

This is the third forest plan for Greenburn, the first and second plans having been submitted and approved in 1999 and 2004 respectively. The plan covers an area of approximately 905ha and continues a general aspiration to maintain production whilst improving the environmental and landscape features. The plan area is dominated by commercial spruce plantation and at the start of the previous plan had limited age and species diversity. Planting started in the 1940s and 1950s in the area to the west of the Old Drymen Road. Most of these early stands were felled in the 1970s and 1980s and a second rotation crop established. The woodland area was also extended north along the side of the Green Burn and to the east of the Old Drymen Road from the 1960s on. Little, if any, of the very earliest planting now remains. The plantation is dominated by Sitka spruce with only small areas of lodgepole pine and few other species. The first two plans introduced a programme of restructuring aiming to achieve a more diverse and resilient forest, aiming to maintain timber production whilst improving the environmental impact of the forest.

2.0 Analysis of previous plan

2.1 Aims of previous plan and achievements

The objectives of the previous plan were described in terms of two main zones: Forest Habitat Network (FHN) and clearfell zone. In addition two small areas of ancient woodland were identified. The proposed FHN covered an area of 335ha and created a framework around which the productive clearfell zone was to be managed. A key objective of the FHN was to link existing features of conservation value and reduce fragmentation of habitats. The aim was to establish a variety of habitats, including open space, comprising mainly native species. Riparian areas are a feature of the network and woodland edges were to be modified to create both ecological and visual diversity. Amongst species that would benefit would be black grouse. In addition, visual diversity would be improved in what was recognised as an increasingly important area for recreational users.

The clearfell zone is the area where commercial timber production is concentrated. Windblow was seen as a major risk and restructuring age class was seen as a priority. Continuous cover forestry (CCF) was not seen as a realistic option and maximum rotation lengths of about 55 years were considered sensible. Felling coupe structure was designed to take advantage of windfirm boundaries and fit underlying topography. At restocking Sitka

spruce was to be the main species of choice but other species were proposed for forest margins and in more visually sensitive areas, for example along recreation corridors.

The previous plan envisaged a programme of phased felling and restocking designed to achieve the above objectives. Although much of this work has been achieved there have been significant changes to the felling programme largely due to extensive storm damage. This has resulted in modifications to coupe size and shape, earlier felling of some coupes and delays to others. Although there have been some relatively large areas of felling the overall impact has probably not been too different from the intentions of the previous plan. Most of the wind damaged trees have now been cleared and restocking has proceeded within the spirit of the 2004 plan, including limited use of species other than Sitka spruce within the clearfell zone. The FHN is now developing as envisaged in places with establishment of native tree species and large areas of open space. In places Sitka spruce natural regeneration is occurring.

A number of temporary tracks have been constructed facilitate management but two proposed roads were not, or only partially, constructed. A new road was built to allow access to windblown areas in the east of the block.

2.2 How previous plan relates to today's objectives

The broad objectives of the previous plan are relevant to the new land management plan. Sustainable timber production remains a key objective, and this will continue to concentrate on the use of Sitka spruce. The extent of the FHN has been reviewed for this plan and management of woodland edges in particular may allow for more extensive growth of naturally regenerated Sitka spruce than the previous plan. Managing sensitively for both conservation and visual diversity remains a key element of the new plan. Key archaeological features will also continue to be protected.

The zones map illustrates the relative importance of the main objectives throughout the area, though there is a degree of overlap between zones.

3.0 Background information

3.1 Physical site factors

3.1.1 Geology Soils and Landform

The Land Management Plan area lies to the south of the Highland Boundary Fault and situated at relatively low elevation on the long northern slopes of a ridge which runs north-west to south-east from the summit of Ben Lomond. Elevation ranges from only 40m to 240m, the steeper slopes at higher elevations quickly give way to a gently sloping plain below 100m. The latter is dissected by a series of south-west to north-east flowing burns which eventually feed into the River Forth at Flanders Moss.

The area is underlain by sandstones and siltstones of Devonian age. These provide the main source of a thin layer of largely fine grained glacial till which covers most of the plan area. There are small areas of coarser glacial material the most significant of which is a narrow linear feature running parallel to the Black Rig Burn. The upper part of the glacial till is frequently indurated. There are extensive areas of deep peat, particularly in the eastern part of the block.

Most of the plan area is covered by Forestry Commission soil maps at a scale of 1:10000. The gentle slopes, fine grained parent material and induration lead to slow drainage and both peaty and surface water gleys are the most frequent soil types. There are also large areas of unflushed and weakly flushed deep peat. Brown earths are indicated as occurring on steeper slopes and field observation confirms this general pattern. However on many sites even subtle changes in slope lead to quite complex patterns of gley and brown earth. Deep peats and unflushed peaty gley will have wet or very wet soil moisture regime and generally very poor soil nutrient regime. Soil nutrient regime will be better in surface water gleys and brown earths will have fresh soil moisture regime.

3.1.2 Water

The burns draining the plateau are steep at first but flow more slowly as they cross the plain. There are several private water supplies and the Loch Katrine aqueducts pass through the forest block. The site encompasses the Kelty Water and Auchentroig Burn catchments. Under the Water Framework Directive, the Auchentroig Burn is at moderate status, downgraded for hydromorphology on the mainstem (not within the forested area). The Kelty Water is at poor status, downgraded for fish ecology (but not fish barriers). There are no known man-made fish barriers in either catchment.

3.1.3 Climate

Using the measures of warmth and wetness defined in the Ecological Site Classification (ESC, see Forestry Commission Bulletin 124) the Greenburn LMP area is categorized as warm and moist at elevations lower than about 180m becoming cool and wet above this. Average annual rainfall is in the range of 1350mm to 1500mm, about 60% falling during the winter months. Most of the area is classed as being sheltered or only slightly exposed, only the very highest parts are considered moderately or highly exposed. No part of the block is considered too exposed for commercial forestry. Measures of exposure do not take account of extreme wind events which can occur periodically.

3.1.4 Future climate

Predicting the impact of future climate change presents one of the biggest challenges in forest planning. In the general area of the plan accumulated temperature is predicted to increase by about 30% by 2050, compared to baseline 1960 – 1990 data following medium to high emissions scenarios. Temperatures will continue to rise and be about 80% greater than baseline data by 2080. Relative increase will be even greater at higher elevations and all parts of the forest are predicted to be classed as warm by 2050. Annual rainfall is predicted to remain more or less the same, a decrease in summer rainfall being compensated by a similar increase in winter. Moisture deficit is predicted to decrease up to 2050 and then begin to rise again towards 2080. The impact of these changes on soil properties is uncertain. Potentially there could be an increase in growth rate in all tree species and a wider range of species may become suitable.

There is less confidence in predicting changes in other climatic parameters such as windiness and extreme winter cold or summer heat. However, there is a general belief that the number of frost days will decrease and that the incidence and severity of extreme events (e.g. gales and heavy rain) will increase. Where exposure is a limiting factor, at present, it seems likely to remain so.

3.2 Biodiversity and environmental designations

Greenburn LMP area is dominated by commercial spruce plantation and has only a small range of habitat types concentrated largely on riparian areas. These support a variety of mammals, birds and amphibians as well as good populations of invertebrates. The network of burns provide important links between the various habitats and between higher and lower ground.

There are very small patches of semi natural ancient woodland and long established plantation indicated on the eastern fringes of the LMP area (see

conservation map). These have been compromised by the spruce plantations and few remnants remain. However one of the sites retains some older native species and is also covered by dense birch natural regeneration. There are narrow strips of native species along many of the burns and some of these are filling with moderately dense native natural regeneration. Relatively rare lower plants have been reported from within the block and other sites close by.

Amongst bird species black grouse occur on the forest margins around Green Hill. Buzzards and sparrowhawks are known to nest. Red squirrels occur with concentrations in some of the older stands. Badgers also found within the block and water voles have spread from the core introduction areas to reach this part of the Forest District.

3.3 The existing forest

3.3.1 Species, age structure and yield class

A total of 22 individual species are currently listed as being present in the forest and one or two others are possibly included in general broadleaved and conifer categories. Most of these make up only a tiny percentage of the overall total, which is dominated by Sitka spruce. Table 3.2 summarises species distribution into major groups. Sitka spruce covers 52% of the plan area and about 83% of the woodland area. Lodgepole pine is the next most abundant species but makes up only 5% of the woodland area and Norway spruce accounts for only 2.8%. There are small patches of Scots pine amounting to less than 0.5% of woodland cover. Other conifers, including larch and Douglas fir, make up just over 3.8% the Douglas accounting for about half the total. Broadleaved species make up 5.5% of the woodland area, the majority of which is of native species, mainly birch. Open ground has been excluded from table 3.2.

Species	Area ha	Area %
Sitka spruce	484.5	83.0
Norway spruce	16.1	2.8
Lodgepole pine	28.7	4.9
Scots pine	2.3	0.4
Other conifer	20.0	3.4
Native broadleaf	21.9	3.8
Other broadleaf	9.7	1.7
	583.2	**100.0**

Table 3.2 Species diversity, Greenburn, 2019

	Area ha	Area %
0-10	173.4	29.7
11-20	139.2	23.9
21-40	237.5	40.7
41-60	30.8	5.3
60+	2.3	0.4
	583.2	**100**

Table 3.3 Age diversity, Greenburn, 2019

Table 3.3 gives figures for age class distribution of the woodland area. The pattern reflects how the restructuring begun 15 – 20 years ago has progressed but has been more recently disrupted by extensive windblow clearance. A combination of fast growth and shallow rooting has resulted in windblow in stands which are less than 40 years of age, even in relatively sheltered parts of the forest. Older age classes are now under-represented and only one first rotation stand from the 1960s remains with a slightly larger area from the 1970s. The few trees greater than 60 years of age are likely to be small stands of native species. This highlights the fact that there was little woodland present before the commercial plantation was established. The percentage of trees aged less than 10 years will increase in the short term as more large areas of windblow clearance are replanted. Looking forward there will be only a slow and limited increase in older age classes if rotation lengths are kept to within 40 – 50 years.

Yield class, (productivity) is measured as maximum mean annual volume increment ($m^3yr^{-1}ha^{-1}$) and there is a wide range in Greenburn. Sitka spruce is the fastest growing species and yield classes of 24 can be achieved at lower elevations on sheltered sites, even on peaty gleys and some deeper peats. Conversely much poorer growth can be found adjacent to fast growing stands where drainage and nutrient availability are poor. Growth at higher elevations is slower and appears to be restricted by both exposure and poor soil conditions. Information on other conifers is limited but Norway spruce can also achieve yield classes up to around 20 and larch about YC14. Data for broadleaved species is also lacking, but yield class 4 -8 should be achievable for faster growing species.

3.3.2 Access

The main access into the forest is off the A81 trunk road at Hoish Farm and the main haul route through the wider Loch Ard Forest passes through the block. This crosses the Old Drymen Road off which there are two other access points. Most of the forest can be accessed by a well-established forest road network.

ATV tracks have been constructed in several coupes to aid management operations, however these are not regarded as permanent features.

3.3.3 Potential for continuous cover forestry

Continuous cover forestry (CCF) systems work best where there are deep, well-drained soils in relatively sheltered situations. In Greenburn the potential for CCF is limited by site conditions, particularly where fast growth can be achieved on shallow rooting soils. Early onset of windblow demonstrates the risk involved in establishing and maintaining these systems of management. There may be potential on some better drained soils, especially where growth might be slower, but success will be dependent on beginning a timely and consistent thinning programme. There is scope for establishing permanent native woodland for landscape, environment and amenity.

3.3.4 Current and potential markets

Although timber prices fluctuate, there is continued demand for softwood timber of all dimensions and it is expected that there will continue to be a ready market for spruce. Future markets for hardwood and other conifer species are uncertain but expectations are that these will develop over time; in particular the demand for biomass for the woodfuel market is expected to grow.

3.4 Landscape and landuse

3.4.1 Visibility, landscape character and value

Low elevation and the relatively flat nature of the northern part of the block mean that Greenburn is not particularly prominent in the landscape. Its most prominent aspect is from the north but these views are distant and the woodland blends with the surrounding landscape. Recent felling has given a greater sense of openness along long distance cycling and walking routes.

3.4.2 Neighbouring land use

To the north lies the wider Loch Ard Forest, also dominated by commercial conifer plantation. To the south is rough upland grazing, but better land is found to the east and north where there is enclosed farmland and improved grazing. There are small patches of ancient semi-natural woodland on the north eastern boundary.

3.4.3 Utilities

The plan area is crossed by a high voltage powerline which then runs north-south along the south western boundary of the forest. There are also low voltage lines serving several properties in the east of the block. Both the major aqueducts bringing water from Loch Katrine to Glasgow pass through the forest and there are several private supplies. Known utilities are shown on the utilities map.

3.5 Social factors

3.5.1 Recreation

Responsible access is welcomed throughout the forest though there may be occasional restrictions during operations for safety reasons. There is car parking where the timber haul route crosses the Old Drymen Road. This is a popular starting point for several formal and informal trails and as a meeting point for those using longer routes. There are several other points that people use to access the forest but the use of the entrance at Hoish Farm is discouraged, partly due to the high level of operational activity in this area. Formal facilities are shown on the recreation map.

3.5.2 Community

There are no formal arrangements with the local community but the woodlands provide a convenient area for informal recreation for members of the public.

3.5.3 Heritage

Known heritage features are shown on the conservation map. These are largely associated with the Katrine aqueducts which were constructed in the mid-19th century.

3.6 Statutory requirements and key external policies

The key policy documents influencing the LMP are the UK Woodland Assurance Standard, the UK Forestry Standard (3rd Edition) and the Scottish Forestry Strategy.

4.0 Analysis and Concept

The analysis and concept map summarises the main issues and aspirations for the LMP area.

4.1 Analysis

- Timber production is a key objective.
- Relatively warm, moist climate and only moderate exposure result in potential for high yields.
- This potential, and species choice, is restricted by soils which are dominated by peaty gleys. There are also extensive areas of deep peat.
- Despite the relative shelter, extreme wind events have resulted in extensive damage to fast growing stands under 40 years of age. This impacts on age structure with knock on effects for future resilience.
- Largely monoculture of Sitka spruce also has implications for future resilience.
- The Green Burn and its tributaries feed, via the Kelty Water, into the River Forth, as does the Auchentroig Burn. There are potential impacts on water quality from forest operations.
- Black grouse occur around Green Hill to the south of the forest block.
- Position in landscape limits prominence; there are distant views from the Lodge Visitor Centre and northern hills.
- Important long distance cycle and walking routes pass through the forest.
- High voltage transmission lines and Loch Katrine aqueduct also pass through the forest. There are a number of private water supplies.
- Known heritage features largely associated with the Loch Katrine aqueducts.

4.2 Concepts of the plan

The main objectives of the plan will be to maintain timber production whilst progressing towards a more balanced and resilient structure. Opportunities for species diversification will be taken where these do not significantly compromise productive potential. Continue to manage the forest for timber production, retaining Sitka spruce as the main commercial species, particularly at higher elevations.

- Seek to maximise productive restocking using Sitka spruce as the main species of choice.
- Devise a coupe structure that takes account of the need to build in future resilience, and is sensitive to any landscape interest.
- Use alternative species where productivity is not compromised and they add to future resilience, with potential additional benefits for ecological and visual diversity.
- Follow guidance on management of afforested deep peat taking account of the potential for carbon sequestration.
- Retain and enhance the existing forest habitat network, using riparian areas to improve resilience in the commercial timber stands.
- Follow Forest and Water Guidelines and minimise risks to water quality.
- Seek modify woodland margins to improve habitats and benefit priority species such as black grouse.
- Maintain the existing recreation infrastructure to provide a variety of interest and experience.
- Protect private water supplies and follow Forest and Water Guidelines during all operations.
- Follow guidelines on heritage features and protect known features, and any newly discovered ones, through appropriate management.
- Establish a suitable deer management programme to protect vulnerable planted and naturally regenerating trees.

5.0 Land Management Plan Proposals

5.1 Management

Management will be guided by the key objectives of the plan. Broad objectives are illustrated in the management zones map though it should be stressed that there will be overlap between zones. The main management technique will be clearfelling and re-planting.

Coupes for which approval to fell is being sought are shown in the management map. All harvesting operations will be carried out in accordance with the UK Forestry Standard Guidelines, Forests and Water Guidelines (5th edition) and precautions taken to protect water courses from, for example, diffuse pollution. Additional precautions will be taken if operations are likely to impact on Drinking Water Protection Areas. The location of distribution mains and private supplies will be confirmed and adequate protection measures agreed prior to operations.

Coupes have been designed to continue the work of re-structuring the forest. Size, location and fell year of coupes are designed to minimise short to medium term risk of wind damage and optimise economic returns. The distribution of windblow, topography and the desire to fell to windfirm edges has resulted in some large coupe sizes. In the longer term a more diverse age pattern should further reduce risk. Although some account has been taken of landscape, size and shape have been largely dictated by existing crop boundaries and topography. Landscape impact is offset the overall landscape scale and distance when seen from the most significant viewpoints. Foreshortening of the view of the upper plateau also helps in this regard. All of the block can be worked by harvester/forwarder. Where possible the year of felling has been set to avoid adjacency issues and to create a diverse age structure in the future. Some coupes, particularly late phase coupes, may have to be revised in future plans if conditions dictate.

Several, mainly broadleaved woodland, stands have been designated as long term retentions These stands will be assessed on a regular basis and future management options determined at that time. Stands of larch will be monitored on a regular basis and any suspected occurrence of Ramorum disease will be further investigated.

5.1.1 Thinning

Little, if any, thinning has been carried out in Greenburn in the past. This may in part been due to perceived windblow risk and the poor economic returns from first and second thinnings. With a better understanding of wind

risk and buoyant timber markets opportunities now exist to begin thinning in some younger stands. Two stands have been identified in relatively sheltered locations where top height is approaching 10m to 15m (see the management map). The prime objective of thinning is to improve timber quality but there may be environmental and landscaping benefits. The results of the work will be assessed and decisions made as to the suitability for a longer term programme in these stands. Results will also be used to determine suitability for thinning elsewhere in the block.

5.1.2 Potential for Continuous Cover Forestry

No stands have been designated for continuous cover forestry in this plan period, although there may be potential in sheltered areas on better soils. Stands that are brought into the thinning programme will be monitored and their potential for CCF assessed.

5.2 Future habitats and species

The future habitats map shows the restocking proposals of the plan. Timber objectives will be met by continuing to use Sitka spruce as the main productive species. Although the climate is suitable for a range of species, the widespread occurrence of peaty gleys and deep peat limits the choice of alternatives to Sitka. However where site conditions allow, where there is potential added benefit in terms of landscape and environment and where there is no significant overall reduction in volume production alternative species to Sitka spruce will be used. Use of alternative species will add to the overall resilience of the forest and provide valuable information to future foresters regarding suitability in a changing climate. There are sites throughout the block where small scale use of species such as Norway spruce, Noble fir and various broadleaves will be appropriate. The use of Lodgepole pine as a nurse to Sitka spruce on poorer, wetter sites will also be given some consideration.

More detailed proposals will be developed following clearfelling, and at the operational planning stage, when site conditions can be better assessed. Where there is extensive deep peat the latest guidance on restocking such sites will be followed. This will take into account the desirability of restoring bog habitat vis a vis establishing an acceptable commercial stand, capable also of meeting carbon sequestration targets.

Buffers along larger burns and between individual restock coupes will provide an opportunity for the extension of open space and/or native woodland. Varied habitats will also be established along the more important visitor routes. The preferred method of tree establishment in these areas will be natural regeneration but small scale planting will be considered as an

option in certain areas. Work will, in part, be determined by available resources and more detailed assessment of options will take place following clearfelling. It is expected that there will be Sitka spruce natural regeneration in some of the buffers between restock coupes. An adaptive approach to management will be taken in these circumstances and the amount of Sitka, or other species, that is accepted will be determined on a site by site basis (see section 5.7). This approach will also be adopted in managing the upper tree line where it borders onto open hill ground.

5.3 Restructuring

The felling programme continues a process of restructuring the forest, which has been developed in previous plans. This process has been disrupted by the extent of recent wind damage. Coupe size is relatively large for the size of the woodland but as discussed above this is largely dictated by ground conditions and a desire to minimise future risk by felling to windfirm edges. Adjacency issues have been avoided as far as possible and future stability will be achieved by replanting Sitka spruce and other species in discrete stands with wide buffers between them.

5.4 Future management

Table 5.1 indicates the area of forest to be felled and volume figures during the plan period. Both gross and net figures are quoted and the latter do not include open areas or components that are deemed non-forecastable due to poor growth. The net area will include a very small proportion of broadleaves that will be retained where possible. Areas of windblown trees are included. The values are approximate and coupes will be surveyed to provide more precise figures prior to felling.

Phase	Area (gross ha)	Area (net ha)	Volume (m^3)
1	29.6	28.2	10250
2	64.8	56.4	26220
	94.4	84.6	36470

Table 5.1 Proposed felling

Table 5.2 summarises the establishment proposals for the plan area and includes both planting and natural regeneration. The figures also include approximately 140.3ha of previously felled ground that will be restocked early in the plan period. This and the open ground figures account for the difference between net area felled and restocked.

	Mixed broadleaves	Mixed conifer	Open	Totals
Phase 1	31.0	107.4	31.5	169.9
Phase 2	15.0	41.6	12.1	68.7
Totals	46.0	149.0	43.6	238.6

Table 5.2 Proposed establishment

Where production is the key objective conifers will be planted at densities of about 2700 stems per hectare and broadleaves in the region of 3500. Target densities for native woodland regeneration will vary depending on site objectives.

Regeneration will be monitored at mid-term review and at re-submission of the plan and future management requirements evaluated based on the results of this. Areas indicated as mixed natural regeneration, on the future habitats map will be allowed to develop a variable density of native and non-native regeneration aiming to achieve an overall tree cover of over 20% in the medium to long term. Open areas will be allowed up to 20% tree cover. Sitka spruce regeneration will be kept within acceptable tolerance limits on both open ground and in areas where the aim is to achieve a native woodland.

5.5 Species tables

Table 5.3 and Figure 5.1 indicate the change in relative species composition between 2019 and 2049. The area of open ground is included in this table and there is further discussion of open ground management in section 5.7. This shows a small reduction in the percentage of Sitka spruce relative to other species over the 30 year period. In fact, the absolute area of Sitka remains steady during this period and indications are it will increase beyond 2049. Other conifers show small relative and absolute decline. It is expected that there will be some variation in these figures depending on site conditions but the overall trend is considered realistic. The amount of native broadleaves is expected to increase significantly, largely through natural regeneration in riparian zones.

Species	2019	2029	2039	2049
Sitka spruce	53.6	58.0	53.5	54.1
Lodgepole pine	3.2	4.0	3.2	3.2
Norway spruce	1.8	2.3	2.3	2.3
Scots pine	0.3	0.3	0.3	0.3
Other conifer	2.2	1.9	1.8	1.2
Native broadleaves	2.4	6.9	8.5	9.2
Other broadleaves	1.1	0.8	0.7	0.7
Open	35.5	25.8	29.7	29.0
	100.0	100.0	100.0	100.0

Table 5.3 Change in species diversity over time in Greenburn (percent LMP area)

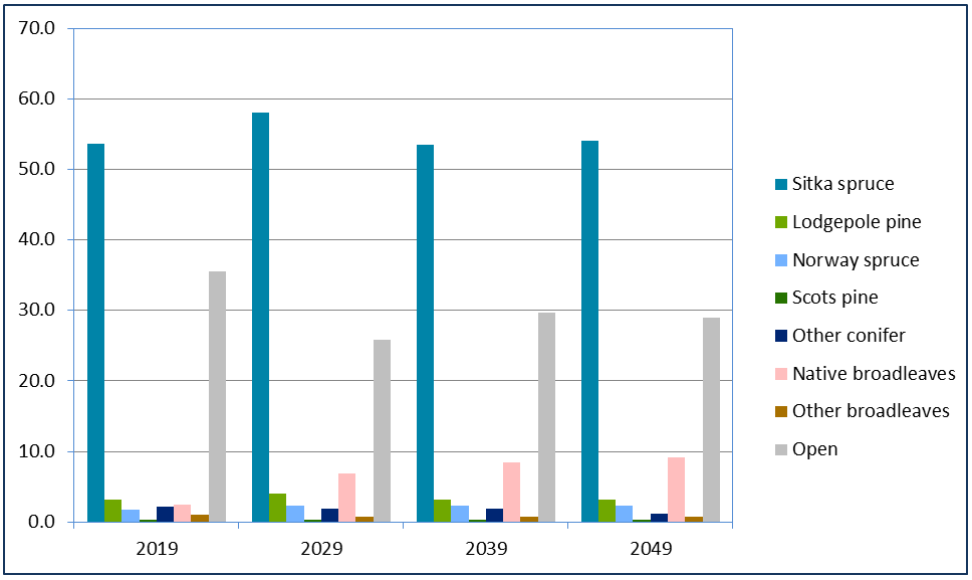

Figure 5.1 Change in species diversity over time in Greenburn (percent LMP area)

5.6 Age structure

Table 5.4 and Figure 5.2 show the change in relative age structure between 2019 and 2049. These figures indicate that it will take some time to achieve a balanced age structure. The sharp peak in stands less than 10 years old is a direct consequence of large scale windblow clearance. The early fall in older age classes which will not be fully compensated for till after 2049.

Age Class	2019	2029	2039	2049
0-10	29.7	26.3	26.4	14.7
11-20	23.9	25.7	24.2	25.6
21-40	40.7	31.9	44.8	49.1
41-60	5.3	15.7	4.1	10.1
60+	0.4	0.4	0.5	0.5
	100.0	100.0	100.0	100.0

Table 5.4 Age structure in Greenburn (percent of forested area)

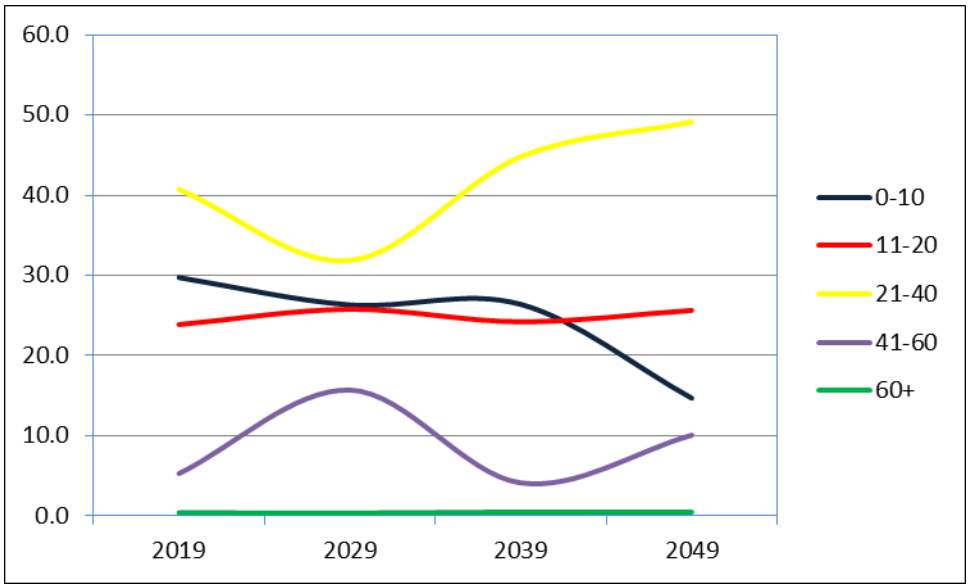

Figure 5.2 Age structure in Greenburn (percent forested area)

5.7 Management of open land

	2019	2029	2039	2049
Forest	64.5	74.2	70.3	71.0
Open	35.5	25.8	29.7	29.0

Table 5.5 Relative area of open ground and forest (%).

Table 5.5 summarises the relative distribution of open ground to forest in 10 year intervals between 2019 and 2049. The figures include transient open space, where felled coupes have not yet been restocked; areas designated "successional" have been divided between open space and native natural regeneration. In addition natural regeneration will be accepted in designated open areas, as long as canopy cover does not exceed 20%. Some of the open space is taken up by the roadline and a buffer zone around this will be kept clear of dense tree growth. Permanent wayleaves make up a moderate percentage of the area and these will be managed in association with the relevant utility company. Open land is also incorporated into most of the restocking coupes though this is not identified specifically in the plan.

5.8 Deer management

Successful establishment of broadleaves and softer conifers will require deer control in order to keep browsing to a minimum. The preferred approach is to manage background deer numbers through culling, bringing numbers down to a sustainable population where browsing damage is at an acceptable level. Fencing may be considered as an option on some sites, for example where shooting is precluded on health and safety grounds. An added benefit of reducing deer numbers will be the improvement of open ground habitats.

5.9 Access

Two short sections of new road will be required to access one first phase coupe. The approximate positions of these are shown on the roads map. The longer of these roads will incorporate a turning point which is included in the area calculations. A number of ramps will also be required to enable harvesting machinery to access felling coupes. The precise location of these will be determined during operational planning but the expectation is that there will be one ramp for approximately 100m of coupe/road interface.

Ramps will be approximately 3m wide and generally up to about 15m long; they will not be treated as permanent features. In addition approximately 7.5km of ATV tracks will be required to facilitate silvicultural operations and deer management on coupes to be restocked. These tracks will be approximately 2m wide and there will be a minimum amount of disturbance when they are being constructed. They will not be treated as permanent features and will be allowed to grass over once restocking is complete. Indicative positions of the tracks are shown in the roads and tracks map. Final position will be within ± 100m of the indicated positions and the nominal area amounts to about 1.5ha. An EIA determination form for roads and tracks is to be found at the front of this document. A written request can be found in appendix IV and a summary in Appendix V.

Material for road maintenance and construction will be obtained from quarries close to the plan area.

The roads and tracks map also indicates access points and haulage routes in and out of the woodlands, with approximate volumes. All timber will come on to the public road at Hoish Farm. That coming from the western part of the block will cross the Old Drymen Road without having to travel along it.

Appendix I: Land Management Plan Consultation Record

Consultee	Date contacted	Date response received	Issue raised	Forest District Response
Forestry Commission Scotland	09/11/17			List of stakeholders sent to FCS.
Loch Lomond and The Trossachs National Park		Attended internal brief setting meeting	Highlighted the black grouse interest in the area.	Objectives relating to improving habitat for black grouse included in the plan.
CONFOR	09/11/17	No response received		
RSPB	09/11/17	09/12/17	Support the concept of managing forest edge for black grouse. If larch cannot be included in restocking proposals it is important to maintain and enhance other food sources (e.g. cotton grass). Variable density native woodland expansion and enhancement will benefit black grouse and other wildlife species. Connectivity of open ground habitats is also important for black grouse. Where clearfell systems remain the dominant management type a well-structured forest can also benefit black grouse. New deer fences should be marked to avoid grouse collisions.	FES will seek to maintain a range of habitats suitable for black grouse. New fencing will be marked.
Scottish Water	09/11/17	08/12/17	Part of the area falls within a Drinking Water Protected Area. Water Quality	DWPA will be indicated on relevant maps in LMP and operations in

			and quantity must be protected. Scottish Water should be notified of any incidents that impact surface water drainage within the Loch Lomond water supply catchment. There are known Scottish Water assets in the plan area, including Loch Katrine water supply aqueducts, a 4" distribution main from Gartmore and private water supply pipes.	DWPA will follow precautions provided by Scottish Water. SW will be notified of incidents impacting DWPA. Location of distribution main and private supplies will be confirmed and adequate protection measures agreed prior to operations. FES will indicate approximate positions on relevant maps in LMP. FES will continue dialogue with SW with regards to operations in vicinity of Loch Katrine aqueducts.
SEPA	09/11/17	08/12/17	There are private water supplies at Corrie Holdings and Drymen Road Cottage. Badivow may have a private water supply. A supply for Corrie Farm is downstream of the plan area. Mainstream of Auchentroig Burn (outside plan area) is only moderate for hydromorphology. Kelty Water (part of which borders the plan area) is poor for fish ecology. Operational work plans should detail all water features and relevant buffer zones and made available to contractors working in the area. General advice to adhere to UKFS and related guidelines. Welcome opportunity to be consulted on site specific issues.	Private supplies will be checked and protected during operations. Forest and Water Guidelines will be followed. Follow Forest and Water Guidelines when working in catchment of these two rivers. Seek opportunities to improve riparian habitat at restocking. Work plans will be developed accordingly. UKFS and guidelines will be followed.
SNH	09/11/17	30/11/17	Objective regarding improving habitat for black grouse noted. Would welcome detail on deer	See section 5.8 of LMP

			management – fencing, displacement compensatory culling. Include comment on protection of water courses from diffuse pollution, referencing Forest and Water Guidelines.	Felling and restocking operations will be carried out in accordance with Forest and Water Guidelines.
SSE	09/11/17	no response received		
Scottish Power	09/11/17	no response received		
Buchanan Community Council	10/11/17	17/11/2017	Asked for information regarding timber extraction routes and whether timber is transported through Drymen. Asked for clearer definition of restocking and whether this included planting of native species. Asked to be kept updated on plan.	Emailed CC explaining that all timber will come to the A81 at Hoish Farm and will not pass through Drymen. This will be indicated in the final plan. Email also explained that restocking includes planting and natural regeneration of native and non-native species. CC to be kept updated on overall plan.
Gartmore Community Council	10/11/17	no response received		
Stirling Council (Roads)	10/11/17	14/11/17	Timber haulage must comply with relevant guidelines. Stirling Council and Community Councils to be informed of timber approximate timber movement.	Guidelines will be followed. Councils will be updated annually with regard to timber volumes being taken form the forest.
Stirling Council (Woodlands and Archaeology)	10/11/17	08/12/17	Refers to the Stirling and Clackmannanshire Forestry and Woodland Strategy (2014) which supports both woodland expansion and restructuring of commercial plantations. The LMP area is surrounded by land identified as	Plan will examine possibility of woodland expansion on forest

			preferred for new woodland planting. Effort should be made to implement a range of objectives: i) use of alternative species to Sitka spruce ii) managing forest edge for black grouse iii) creating diverse edges along long distance routes Guidelines for planting in Stirling Council's supplementary guidance SG28 include; i) addressing issue of unsympathetic margins and lack of diversity ii) enhancement and expansion of native woodland network, especially where there are relic features and along riparian zones. No known archaeological remains in that part of the plan area within SC boundary.	margins looking to meet a range of objectives, including improvement of habitat for black grouse and to improve visual amenity. Timber production will remain a chief focus of the plan but opportunities to use alternative species to Sitka spruce will be examined. FES will seek to improve visual appearance of forest margins and along long distance routes. FES will examine opportunities to enhance and expand native woodlands.
Mountaineering Scotland	10/11/17	05/12/17	Would welcome greater diversity in age structure and an increase in area of native species. Also a commitment to improving visual impact of the forest. MS note the attention given to black grouse habitat and that the Rob Roy Way passes through the LMP area. Access rights should be respected and taken into account during the planning process – intention to maintain existing public access routes should be stated in the final proposals.	FES will seek to introduce greater age diversity in the long term and introduce a limited number of alternative species to Sitka spruce where site conditions allow and there is no significant reduction in productive potential. FES will seek to improve visual appearance of woodlands. Responsible access is welcomed and FES will seek to maintain existing access routes. Relevant guidelines will be

			Operations should follow relevant guidelines. Encourage consideration of potential new access routes.	followed. Potential new access can be considered but would be dependent on sufficient funding being available for implementation.
Sustrans	10/11/17	No response received		
Friends of Loch Lomond and The Trossachs	10/11/17	No response received		
Scottish Wild Land Group	10/11/17	No response received		
Forth District Salmon Fisheries Board	10/11/17	No response received		
Clear Services Ltd. (Lepidoptera)	10/11/17	10/11/17	No comments made.	
BSBI Plant recorder	10/11/17	via Jane Jones	Three old records of rare plants in the vicinity of the LMP area. Two of these are in native woodland outside the area.	Be aware of the possibility of rare plants in riparian areas and native woodland remnants and provide adequate protection if found.
Central Scotland Raptor Study Group	10/11/17	No response received		
Buchanan Castle Estate	10/11/17	no response received		

Appendix II. Scoping Record and Design Brief

Greenburn Land Management Plan: Scoping Report

Scoping was carried out by post and a number of stakeholders contacted in November 2017.

A summary of responses is given in Appendix I

An internal meeting was held on 13th April 2017 and a draft set of objectives drawn up. Further advice was taken from operational staff and final objectives reflect the aspirations of both internal and external stakeholders.

Objectives

The objectives of the new plan, which were developed following internal and external consultation, are summarised overleaf and emphasise the key principals of maintaining the productive potential of the forest whilst delivering a range of other ecosystem services into the future.

Design Brief

The objectives of the new plan, which were developed following internal and external consultation, are summarised below and emphasise the key principals of maintaining the productive potential of the forest whilst delivering a range of other ecosystem services into the future.

In the longer term establish rotation lengths that improve resilience by diversifying age structure whilst aiming to maximise economic potential.

Continue to manage the forest for timber production, maximising potential by using Sitka spruce as the main species of choice.

Ensure the plan remains UKFS compliant by introducing a limited amount of diversity into productive areas where this does not significantly reduce volume production.

Use habitat networks to further increase diversity and improve resilience to wind damage.

Manage the upper forest edge to improve habitat for black grouse.

Create diverse woodland margins along major long distance recreation routes.

Afford adequate protection to Loch Katrine aqueducts and private water supplies during operations. Forest and water guidelines will be followed during forest operations. At restocking create adequate buffers along the routes of these facilities.

An appropriate deer management programme will be established to protect vulnerable planted stock and allow natural regeneration where this is the favoured method of establishment.

NB: All forests managed by FCS are certified under the UK Woodland Assurance Scheme (UKWAS), which requires forests to be managed sustainably. The UKWAS is part of the Forest Stewardship Council (FSC) scheme, which allows timber sourced from certified forests to carry the FSC label. Callander FDP will incorporate the various requirements of UKWAS within its proposals.

Appendix III: Tolerance Table.

	Adjustment to felling coupe boundaries	Timing of restocking	Change to species (including boundaries)	Windthrow clearance	Changes to road lines
FC Approval not normally required	Up to 1ha or 10% of coupe - whichever is less	For productive species, up to 3 planting seasons after felling Up to 10 planting seasons for natural regeneration	Change within species group i.e. diverse conifers; broadleaves; Sitka spruce. Non native conifers in native woodland areas and designated open space up to 400 stems/ha. <20% increase in area of Sitka spruce	Up to 2ha as a single unit with >50%windblow	
Approval by exchange of letters and map	1ha to 5ha or 20% of coupe - whichever is less	For productive species, 3 – 5 years after felling	>20% increase in area of Sitka spruce	Up to 5ha	Additional felling of trees not agreed in plan Departures of >60m in either direction from centre line of road
Approval by formal plan amendment	More than 5ha	For productive species, over 5 planting seasons after felling	Change from specified native species Change between species groups	More than 5ha	As above, depending on sensitivity

Appendix IV. EIA Determination request

Greenburn LMP –roads, tracks and ramps

This is a request for an EIA determination for works covering construction of roads, tracks and ramps in Greenburn LMP area. The request covers proposals for the full ten year period of the plan which will offer some flexibility with the work programme without the necessity of having to re-submit a determination. Any work to be carried out in the second half of the plan period will be preceded by a new EIA determination request.

Approximately 550m of new roads and 7500m of tracks will be required to access harvesting sites and to facilitate harvesting, silvicultural and deer management operations. In addition up to 30 ramps will be required to allow harvester/forwarder access into coupes that are to be felled during the design plan period.

Proposed roadlines have been surveyed and their positions are shown on the roads and tracks map. A more detailed assessment of routes will be made prior to construction and a tolerance of ± 60m adhered to. The footprint of roads will be approximately 7m and the nominal area amounts to 0.4ha. The latter figure includes a turning area. Several roads will require to be upgraded prior to operations, however the nominal footprint of the road will not be increased. All work will be carried out in accordance with standards set out in the most up to date guidelines.

Tracks will be constructed in line with the principles described in the SNH guidance on Constructed Tracks in the Scottish Uplands. Construction will also conform to the Forests and Water Guidelines (Fifth Edition). During construction ground disturbance will be kept to a minimum. ATV tracks will not be treated as permanent features; once operations are complete tracks will be allowed to grass over and the running surface and side batters will be left in a condition that will promote vegetation regeneration. Tracks will be constructed with a top-side drain and will have regular drainage cut-offs to prevent erosion of the trackside drain. No water from the trackside drains will discharge directly into any watercourse.

Indicative positions of the tracks are shown on the roads and tracks map and final positions will be within ± 100m of these. The actual line will be planned to minimise landscape impact and ground disturbance, reflecting existing topography, avoiding steep gradients where possible and avoiding sensitive habitats. ATV tracks will be approximately 2m wide and the nominal area amounts to 1.5ha.

Ramps will be approximately 3m wide and up to about 15m long. The nominal area is approximately 0.14ha. They will not be treated as permanent features and will be removed following operations. The final

number and location of the ramps will be determined at the time of operations but we believe one ramp per 100m of road/coupe interface will be sufficient.

An EIA determination request form is to be found at the front of this document and a summary of proposed works in Appendix VI. A revised EIA determination will be sought if any specific sensitive issues are encountered before construction.

1	Landscape	There are no major landscape issues with either roads, tracks or ramps.
2	Watercourses	All work will conform to the 5th edition of the UK Forestry Standard Guidelines "Forests and Water".
3	Archaeology	Where archaeological features are known to occur these will avoided. Care will be taken to avoid damage to any new features discovered during operations.
4	Biodiversity	Work carried out will be sensitive to permanent and temporary features of conservation value (e.g. spawning frogs and toads in roadside drains).
5	Access	There are no major access issues.
6	Recreation	Construction will not impact on the informal use of existing roads and tracks.
7	Material	ATV tracks will use material from on site. Material suitable for roads and ramps will be sourced from local FES quarries.

Appendix V. EIA Determination summary - forest roads and tracks

Coupe	Length (m)	Area (ha.)	Purpose	Landscape	Water quality	Archaeology	Biodiversity	Access	Recreation	Material
35042	550	0.40	access for harvesting	no major issues	no known issues	no known issues	no significant issues	from existing forest road	n/a	nearest FES quarry
35042	1300	0.26	crop establishment and deer management	no issues	standard protection measures	no known issues	no significant issues	from forest road	n/a	to be found on site
35010	1500	0.30	crop establishment and deer management	no issues	standard protection measures	no known issues	no significant issues	from forest road	n/a	to be found on site
35012	950	0.19	crop establishment and deer management	no issues	standard protection measures	no known issues	no significant issues	from forest road	n/a	to be found on site
35026	1150	0.23	crop establishment and deer management	no issues	standard protection measures	no known issues	no significant issues	from forest road	n/a	to be found on site
35039	1100	0.22	crop establishment and deer management	no issues	standard protection measures	no known issues	no significant issues	from forest road	n/a	to be found on site

VI Additional tree felling

FLS will normally seek to map and identify all planned tree felling 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.

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.

The maximum volume of felling in exceptional circumstances covered by this approval is 40 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.

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