

LOCH KATRINE

ENVIRONMENTAL STATEMENT

October 2007

Revised October 2008

CONTENTS

Non-technical summary	1-22
Acknowledgements	22
1. INTRODUCTION	23
<u>1.1 Location of the Site</u>	23
<u>1.2 Background to the Site</u>	23
<u>1.2.2 Integrated Catchment Management</u>	24
<u>1.2.3 Current site management</u>	25
<u>1.2.4 Past woodland work</u>	25
<u>1.3 Objectives for the Land</u>	26
<u>1.4 Works Proposed under this Environmental Statement</u>	27
<u>1.5 The Environmental Statement</u>	28
<u>1.6 Scoping Meeting</u>	29
2. SITE DESCRIPTION	31
<u>2.1 General Description</u>	31
<u>2.2 Policy Context, Statutory and Other Designations</u>	33
<u>2.2.1 Loch Lomond and Trossachs National Park (LL&TNP) Policies</u> ...	33
<u>2.2.2 Strategic Forestry and Woodland Policy Context</u>	35
<u>2.2.3 Landscape Designations</u>	36
<u>2.2.4 Conservation Designations</u>	36
<u>2.3 Climate</u>	37
<u>2.4 Elevation and Aspect</u>	38
<u>2.5 Geology</u>	38
<u>2.6 Soils</u>	39
<u>2.7 Geomorphology and Topography</u>	39
<u>2.7.1 Glacial features</u>	39
<u>2.7.2 Rock Slip Failure (RSF) Complexes</u>	40
<u>2.7.3 Topography</u>	40
<u>2.8 Water Quality and Hydrology</u>	41
<u>2.8.1 Water quality</u>	41
<u>2.8.2 Hydrological Yield</u>	42
<u>2.8.3 Land Use Change Impacts on Water Yield</u>	42
<u>2.9 Non-woodland Habitats and Plant Communities</u>	43
<u>2.9.1 Extent of survey information</u>	43
<u>2.9.2 Habitats and communities (non-woodland)</u>	44
<u>2.9.3 Bryophytes and Fungi</u>	46
<u>2.10 Existing trees and woodlands</u>	47
<u>2.10.1 Woodland Types and distribution</u>	47
<u>2.10.2 Past Management and Regeneration Potential</u>	50
<u>2.11 Birds</u>	51
<u>2.12 Other Fauna</u>	54
<u>2.12.1 Mammals and Reptiles</u>	54
<u>2.12.2 Invertebrates</u>	55
<u>2.13 Historical context and land use</u>	56
<u>2.14 Cultural Heritage and Archaeology</u>	58

2.14.1	Historic land Use Assessment (HLUA)	58
2.14.2	Survey Information	58
2.15	Tourism and recreational use of the site	60
2.15.1	Tourism and tourist facilities	60
2.15.2	Existing paths and links	61
2.15.3	Links to long distance routes outside the catchment	62
2.16	Landscape Character Assessment	63
3.	DESCRIPTION OF PROPOSALS	69
3.1	Location	69
3.1.1	Bracken Control	69
3.1.2	Deer Control and Protection	69
3.1.3	New Planting	69
3.1.4	Natural Regeneration	70
3.1.5	Woodland Management	70
3.1.6	Removal of Non-native Species	70
3.1.7	Conifer Felling and Conifer Retentions	70
3.1.8	Access Works	71
3.1.9	Grazing	71
3.2	Area Statement	71
3.3	Alternative optionsfor the site and choice of current proposals	72
3.4	Plan Proposals	74
3.4.1	Bracken Control	75
3.4.2	Deer control and Protection	75
3.4.3	Species Choice	75
3.4.4	Ground Preparation	77
3.4.5	Planting	77
3.4.6	Fertilizer	78
3.4.7	Weeding	78
3.4.8	Natural Regeneration	78
3.4.9	Woodland Management	79
3.4.10	Removal of Non-native Species	79
3.4.11	Conversion of Conifer Areas to Native Woodland and PAWS Restoration	79
3.4.12	Landscape Design	80
3.4.13	Protection of Archaeological Features	82
3.4.14	Access Work	83
3.4.15	Grazing	86
3.4.16	Monitoring	87
3.5	Work Methods and Design	87
3.5.1	Bracken Control	87
3.5.2	Deer Control and Protection	88
3.5.3	Species Choice and Planting Stock	89
3.5.4	Ground Preparation	89
3.5.5	Planting	89
3.5.6	Fertilizer	90
3.5.7	Weeding	90
3.5.8	Natural Regeneration	91

3.5.9	Woodland Management	91
3.5.10	Removal of Non-native Species	91
3.5.11	Treatment of Conifer Areas and PAWS Restoration	92
3.5.12	Landscape Design and open space	93
3.5.13	Protection of Archaeological Features	96
3.5.14	Access	98
3.5.15	Grazing	100
3.5.16	Monitoring	101
3.5.17	Standards of Work	102
4.	IMPACT PREDICTION, ASSESSMENT AND MITIGATION	103
4.1	Public Water catchment	103
4.1.1	Evaluation	103
4.1.2	Mitigation	104
4.1.3	Issues raised during scoping meeting	107
4.2	Landscape	109
4.2.1	Evaluation	112
4.2.2	Mitigation	114
4.2.3	Issues raised during scoping meeting	116
4.3	Conservation - Habitats and communities	118
4.3.1	Evaluation	118
4.3.2	Mitigation	119
4.3.3	Issues raised during scoping meeting	122
4.4	Conservation – Birds	123
4.4.1	Evaluation	123
4.4.2	Mitigation	129
4.4.3	Issues raised during screening and scoping meetings	131
4.5	Conservation – Fauna	132
4.5.1	Evaluation	132
4.5.2	Mitigation	133
4.5.3	Issues raised during screening and scoping meetings	135
4.6	Deer	135
4.6.1	Evaluation	135
4.6.2	Mitigation	136
4.6.3	Issues raised during the scoping meeting	137
4.7	Archaeology	137
4.7.1	Evaluation	137
4.7.2	Mitigation	139
4.7.3	Issues raised during scoping meeting	142
4.8	Access and recreation	143
4.8.1	Evaluation	143
4.8.2	Issues raised at the scoping meeting	145
5.	SUMMARY STATEMENT OF THE SIGNIFICANT IMPACTS	145
5.1	Summary of Impacts and Mitigation Measures	145
5.2	Discussion of Residual Impacts	160
6.	Annex to ES following Public Consultation	163

APPENDICES

- Appendix 1 : Scoping Report
- Appendix 2 : Interim Management Plan
- Appendix 3 : Loch Katrine Areas of Geomorphological and Landscape Interest
- Appendix 4 : Baseline Hydrological Assessment of the Loch Katrine and Loch Arklet Catchments
- Appendix 5 : Loch Katrine Land use Change Impacts to Yield
- Appendix 6: NVC Survey Loch Katrine
- Appendix 7 : SSSI Management Plan
- Appendix 8 : Moorland Bird Survey
- Appendix 9: Archaeological Sites - GUARD Survey
- Appendix 10: Archaeological Sites – Headland Survey
- Appendix 11a: Landscape Analysis and Assessment
- Appendix 11b: Landscape Perspectives
- Appendix 12 : ESC Analysis
- Appendix 13 : FCS Forest management Guide 6: Footpath Construction Technical Specification
- Appendix 14: Primrose Hill Forest Road Extension and layby details
- Appendix 15: Glossary
- Appendix 16 : Bibliography

MAPS:

- Map 1 : Location Map
- Map 2 : Landscape Constraints
- Map 3: Conservation Constraints
- Map 3a: Conservation Constraints Woodland
- Map 4a: Archaeology Constraints GUARD data
- Map 4b: Archaeology Constraints Headland Data
- Map 5: Existing and Proposed Access
- Map 6: Woodland Proposals

NON TECHNICAL SUMMARY

BACKGROUND

Loch Katrine, together with Loch Arklet and surrounding hills has long been recognised as one of the outstanding scenic areas of Scotland. In addition to providing recreational and landscape benefits, the lochs are also of vital public importance with Loch Katrine being Glasgow's main source of drinking water since the mid 19th century. The area is now located at the heart of the recently created Loch Lomond and the Trossachs National Park.

An Integrated Catchment Management Plan (ICMP), produced in 2002, recommended the land surrounding the catchment should be managed primarily for native woodland and biodiversity. The Forestry Commission Scotland (FCS), took on this responsibility under a 150 year lease agreement in 2005 and produced an Interim Management Plan (IMP) for the area. This plan proposed the felling of most of the remaining conifer plantations, substantial expansion of native woodland through a combination of planting and natural regeneration, and the development of a number of new paths to improve access for visitors. Due to the sensitivity of the area and the scale of proposals, under the Environmental Impact Assessment (Forestry) (Scotland) Regulations 1999 an Environmental Statement was required to examine the impacts of the proposed works.

INTRODUCTION

Primary Aims of the Loch Katrine Scheme

The primary objective is to substantially expand the native woodland resource over the next 20 years whilst also providing a range of conservation biodiversity and tourism benefits. Grazing may be used to assist in achieving these aims.

Requirement for an Environmental Statement

The primary reasons for requiring an environmental statement are to examine the impact of proposals on:

1. Public Water Catchment
2. Landscape
3. Conservation (Habitats, Birds and Animals)
4. Deer
5. Archaeology

SITE DESCRIPTION

The Loch Katrine catchment area is located in the heart of Loch Lomond & The Trossachs National Park, 14 km due east of Callander and 17km north west of Aberfoyle. The area is located on OS 1:50,000 Landranger Map Sheets 56 and 57. The site extends to 9597ha around Lochs Katrine and Arklet and includes Ben A'an and Ben Venue. (see Location Map 1).

The landscape around the catchment has been shaped by the action of ice and subsequent erosion of the hard underlying rocks. At the eastern end of Loch Katrine, the landform is complex, with slopes interrupted by knolls, hummocks and extensive areas of exposed rock faces and an irregular loch shoreline. Further west, slopes are longer and smoother, leading less steeply up to rounded rocky skylines, with wide valleys of tributary burns.

The importance of the area as a water supply catchment is due to a combination of climate and geology. Water from the Loch Katrine catchment is of high quality and has a low nutrient content (as measured by phosphates and nitrates, among other indicators). Grazing of sheep in the catchment was stopped in 2002, until construction of a new filtration plant at Milngavie could be completed (due in 2007).

A study to assess the water yield of the catchments in 2005, found that increasing the woodland area would not have a noticeable effect on water yield.

Vegetation across the upland areas, includes large areas of blanket bog, interspersed by moorland vegetation. On the steeper slopes, the vegetation is a mixture of moorland and heathland, much of which has become grassy through heavy grazing by sheep and woodland is limited to the less accessible burn-sides and gullies. On the valley sides above Loch Katrine, pasture is found on better land in pockets around the loch, with grassy heath higher up. Areas of native woodland are concentrated on steeper lower slopes above the loch and have been managed through the ages to provide fuel, timber, fodder and tanbark for the local population. These woodland areas are now regarded as ancient woodland.

Existing woodland

There are a total of 890ha of existing broadleaved woodland and 122ha of conifer plantation within the catchment lease area, with 210ha of developing woodland (See Maps 3a and 6). 604ha of the broadleaved area (including the protected Ben A'an and Brenachoile Site of Special Scientific Interest) is classed as ancient semi-natural woodland (ASNW) and about 65ha of the remaining conifer plantations occupy ancient woodland sites and are classed as Planted Ancient Woodlands (PAWS).

Existing broad-leaved woodlands are divided into four broad types, all of which are included as priority habitats under the EU habitats directive and the UK Biodiversity Action Plan. **Upland oakwood** and **upland birch wood** are the most extensive types and small pockets of **wet woodland** and **upland mixed ashwood** occur within these. In some places trees are too old to produce seed, but elsewhere regeneration is good and seedling survival has improved since sheep were removed from the catchment.

Birds

A moorland bird survey recorded a total of 68 bird species on the site. 35 are included on British Trust for Ornithology (BTO) red and amber lists of species under threat, or of concern. 9 different birds of prey were recorded. Species considered as priority species locally or in the UK include **Bullfinch, Linnet, Raven, Reed Bunting, Skylark, Song Thrush, Spotted Flycatcher, Black Grouse and Golden Eagle, Hen Harrier, Merlin, Peregrine, Short-eared owl and Curlew**. 34 of the recorded species require woodland, scrub or trees as their primary habitat. Seven species, **Meadow Pipit, Skylark, Red Grouse, Curlew Snipe, Hen Harrier, Short-eared Owl and Golden Eagle** are more associated with open ground habitats. The two species of greatest local interest in terms of potential woodland impact are Golden eagle and Black Grouse.

Deer

Both **Red and roe deer** are present in the area. Deer numbers have increased following the removal of sheep in 2002 and culling is undertaken to keep numbers at a level which allows woodland regeneration to occur.

Other animals

Other animals reported in the area include **Otters, Pine marten, Red Squirrels Badgers** and four species of bat: **Pipistrelle bat, Long-eared bat, Natter bat and Daubenton's bat**. **Water vole** may be present. Reptiles include the **Common Lizard** and **adders**. Older butterfly records include **Pearl Bordered Fritillary** and **Green-veined White**, with **Small Pearl Bordered Fritillary** noted recently, as well as a moth, the **Small Chocolate Tip**. The Ben A'an and Brennachoile SSSI woods are known to hold beetles and hoverflies of note as well as several nests of **Small Headed Wood Ants**.

Archaeology

The main archaeological interest of the catchment is found in collections of remains of 18th -20th century interest. To date a total of 176 features or sites of archaeological interest have been surveyed within the Loch Katrine and Loch Arklet catchments, of which 166 lie within the lease area. There are no sites of regional or national importance, but remains found are of local significance and provide a rich record of cultural history of the area, especially from the 18th and 19th century.

Features found include numerous building remains, deserted farmsteads and settlements and associated tracks, enclosures and areas of cultivation as well as stone dykes and banks. Remains also exist of the Military road to the Garrison at Inversnaid. Industrial remains include lime and other drying kilns and bloomeries (slag heaps representative of iron workings). These are listed in Appendix 9 and 10 and shown on maps 4a and 4b.

Public Access and Tourism

Loch Katrine has been an important tourist destination within the Trossachs, since the late 18th century. Visitor number estimates range from 180,000 to 250,000 and numbers are predicted to increase further following the establishment of the LL&TNP in 2002.

The existing tourist facilities are concentrated at the Trossachs Pier and include boat trips on the Sir Walter Scott steamer which runs between the Trossachs and Stronachlachar Piers, a café, shop, bike hire and trout fishing facilities. The Loch Katrine area is well used by walkers and cyclists, with the Shore road around Loch Katrine being the main available low level route. Whilst there is little scope to expand facilities around the loch, opportunities do exist to make more of the existing resources. The Sir Walter Scott Trust is seeking to run a shuttle boat, which will eventually visit some of the smaller jetties around the loch and opportunities exist to combine this development with construction of additional paths to provide alternative opportunities for walkers and cyclists. There is also scope for the creation of strategic off-road links to both east and west of the catchment, to link into existing long distance paths and path networks.

Landscape character

The landscape character describes an area in terms of all of the physical, ecological and cultural influences on the landscape. The draft NP Landscape Character Assessment identifies nine landscape character types (LCTs), found in the catchment area. For each of the LCT's, sensitivities and opportunities for landscape change have been described and this information provides a framework for considering proposals such as those made in this ES, which may alter the landscape. These are summarised in Table 21 in the main report.

DESCRIPTION OF THE PROPOSAL

Area Statement

Category	Net area ha.	Gross area ha.	% of area
Existing woodland			
Existing broadleaved woodland	890	890	9%
Conifer area (to be felled and converted to native woodland)	105	156	2%
Conifer area to be retained	17	17	not significant
WGS area managed by FCS (native woodland planting and regeneration)	210	313	3%
Subtotal of existing woodland	1222	1376	14%
Proposed New woodland			
New native woodland planting	800	1152	12%
Proposed expansion through natural regeneration	566	821	9%
Subtotal of proposed new woodland	1366	1973	21%
Other land			
Open land habitats		6248	65%
Subtotal other land		6248	65%
Subtotal woodland (new and proposed)	2588	3349	35%
Total Area		9597	100%
Note: Average internal open space within woodland is 32%			

Plan proposals

The main objectives for the catchment include the felling of 105ha of remaining conifers and creating key habitat network links by expanding native woodland cover by 2000ha within 20 years. 60% of this area (800ha) will be achieved by new planting, the remainder by natural regeneration. Planting is required to meet the timescales and will also allow the introduction of additional tree species that are under-represented in existing woodland communities. See Woodland Proposals Map 6 and Constraints Maps 2, 3, 3a, 4a and 4b. Invasive Rhododendron will also be cleared. Appendix 11a includes views of the proposed new woodlands from various viewpoints around the lochs.

In addition to woodland expansion, visitor access will be improved by the construction of an additional 5450m of local paths. These will create a number of shorter circuits which will provide alternative routes to the Shore road and new higher level viewpoints around the loch. As well as local paths, the construction of a

new 9800m path along the Military Road will provide off-road access to cyclists and walkers along Loch Arklet and an upgrade to an existing hill path up Ben A'an is proposed (see Map 5, Existing and Proposed Access).

IMPACT PREDICTIONS, ASSESSMENT AND MITIGATION

Evaluation

WATER CATCHMENT

Proposals to expand woodland cover from 14% to around 34% of the catchment may affect the amount of water entering the reservoirs and consequently water yields. Various operations proposed, including felling, ground preparation, path construction work and use of chemicals for weeding and fertilizers have the potential to contaminate the water supply, if not well-managed. Contamination can arise from chemicals or machine fuel and oils entering water courses directly through accidents and spills, or indirectly, if carried into the reservoirs by rainfall. Also, machine operations can affect local drainage and soils leading to erosion, which allows silt to enter watercourses or the lochs. Presence of livestock, where grazing is undertaken, may allow more micr-organisms to enter the water supply and impact on water quality.

LANDSCAPE

The area lies at the heart of the scenic Loch Lomond and the Trossachs National Park. Loch Katrine is an important centre for visitors, with the landscape being a key attraction. Works proposed include felling of some existing conifer areas, significant expansion of the native broadleaved woodland area by planting and regeneration and the construction/upgrading of a number of new paths within the area. Planting will require ground preparation and the erection of deer fencing. All of these operations have the potential to impact on the landscape and on important viewpoints within and around the area.

CONSERVATION- HABITATS

Almost all land within the catchment consists of semi-natural habitats, many of which are considered as priority habitats, to be protected under local, UK or European legislation. Expansion of woodlands onto these habitats will have implications for the habitats that will be replaced, species dependant upon them and upon the biodiversity of the site as a whole.

CONSERVATION - BIRDS

The catchment includes a wide range of bird species, many of which are considered to be of conservation concern, or are priority species under local and UK biodiversity action plans, or protected under European legislation. Some species are

of concern due to their rarity, or declining numbers. Expansion of woodlands will affect the area of open ground habitats and may impact upon bird species dependant on these. Deer fencing can also be a problem for Black Grouse, in particular, as birds may fly into fences. Other species can be sensitive to disturbance, especially during the breeding season. This may occur directly as a result of work is undertaken close to nesting sites or indirectly through noise or the presence of people.

CONSERVATION - ANIMALS AND INSECTS

A number of protected mammal and insect species have been reported as being present within the catchment area. Others species may be present, but have not been specifically recorded to date. Proposals to fell conifers, manage existing woodlands and to expand the area of native broadleaved woodland may potentially impact on breeding or feeding habitats used by these species. Some species may be sensitive to disturbance by machinery noise or due to the presence of people.

DEER

Deer management will be required, not only to achieve the proposed natural regeneration and woodland expansion, but also to prevent over-grazing of open ground habitats. Both deer fencing and culling are proposed as part of the scheme. Fencing has implications for access and for the landscape, whilst culling has impacts on neighbouring landowners, habitat biodiversity and visitor experience to the area.

ARCHAEOLOGY

The area contains a significant concentration of remains which provide evidence of the recent cultural history of the area. The significance of such remains can be lost where woodland expansion affects the setting of features and obscures their relationship to each other. Archaeological remains can also be damaged directly by tree root disturbance, or by machinery operations, such as felling, ground preparation and path construction. Remains can also easily be lost or obscured within or outwith woodland area, especially once colonised by grass, bracken or scrub, where sites are not recorded or marked. Proposed new access along the lines of the Military Way and 18th century Statute Road, will affect these and associated archaeological features.

Impacts and Mitigation Measures

The tables below summarise the main areas where environmental impacts of the project are of importance, mitigation measures that are proposed and the residual impact.

PUBLIC WATER CATCHMENT			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Increased tree cover within water supply catchment	Reduction in rate/total amount of water entering the supply system	Yield impacts of native broadleaved woodland are less than conifer. A hydrological assessment of impacts of increasing tree cover by double the amount actually proposed in this ES, found that there would be no measurable impact on water yield.	Not found to be significant
Use of chemicals	Contamination of water supply through spillages or run-off or leaching of chemicals into watercourses and lochs	Forests & Water Guidance (Edition 4) to be followed as a minimum; Buffer areas to be maintained along watercourses; handling and application of herbicides to follow labels and guidance, with no storage, filling or washing of containers within buffer areas. Chemical use to be limited to Glyphosate, Propyzamide and Asulox. Operators to be familiar with accident contingency plans and have materials to hand to contain or soak up spills; reporting mechanisms to be put in place to alert both SW and SEPA to any incidents	Not significant
Use of fertilizers	Nutrient enrichment and contamination of water supply or detrimental impact on fisheries	Forest and Water Guidelines (Edition 4) to be followed as a minimum. Site plans to detail constraints, working practices and buffer areas. Fertilizer only to be used where required. Granular or ground rock phosphate or PK (0:20:20) to be applied by hand to individual trees, post planting.	Not significant
Grazing	Adverse impacts to water quality from enrichment or pollution	Low intensity grazing, with few animals. Any handling facilities to be built to approved standards and sited to prevent any slurry entering water courses; new filtration plant at Milngavie to be completed prior to any grazing being undertaken. Water quality monitoring will be undertaken.	No negative effects on water quality

PUBLIC WATER CATCHMENT			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Harvesting, ground preparation or road/path construction operations especially those requiring crossing of water courses	Increased run-off, erosion and sedimentation and resultant reduction in water quality and/or detrimental impact on fisheries	Forests & Water Guidelines (Edition 4) to be followed as a minimum; Liaison with SEPA to be undertaken at planning stage of all works and authorisation obtained where required under CAR regulations; Water crossings to be minimised and FCS to assess all water crossings at planning stage to identify necessary protection measures. Discontinuous methods of ground preparation to be used, with any ditches ending short of ephemeral or permanent drainage channels; Buffer areas to be observed along watercourses which will be kept clear of branches, debris and brash; Harvesting to be undertaken in driest seasons where possible and build up of surface run-off prevented on extraction tracks with bunding of stacking areas if sediment run-off becomes a risk during high rainfall . Local watercourses to be inspected for evidence of sediment inputs and remedial action taken if found.	Some local negative impacts unavoidable, especially during periods of high rainfall, but should not affect loch water quality
Harvesting, groundworks or road/path construction operations ; layout using ATV, weeding and vegetation control operations	Chemical, fuel or oil spillages leading to contamination of the water supply and/or detrimental impact on fisheries;	Forests & Water Guidelines (Edition 4) to be followed as a minimum; Site plans will detail constraints, working practices and buffer areas to be maintained along watercourses; Storage, filling or fuelling operations to be undertaken at safe locations; Operators to be familiar with spills contingency plans and have materials to hand to contain or soak up spills; reporting mechanisms to be put in place to alert both SW and SEPA to any incidents.	Some limited local impacts possible, but should not affect water quality

PUBLIC WATER CATCHMENT			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Fire	Adverse impacts to water quality as a result of fire fighting	All possible measures will be taken to reduce the hazard in periods of high risk. In the event of fire, no foam will be used as a suppressant within the catchment and Loch Katrine is to be used as a source of water in the last resort.	No negative effects arising solely as a result of ES proposals; fire hazard exists regardless of vegetation changes

LANDSCAPE			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
New planting Impact on landscape character and scenic quality of area	Quality and extent of specific, typical and iconic views	LCT opportunities and sensitivities have been taken into account in woodland design. Landscape Assessments of impacts of establishing and mature woodlands have been made from 19 main and 12 secondary viewpoints within the site and from vantage points around the area to ensure woodland design will enhance views	Positive
Woodland expansion	Retention of mosaic of open and wooded ground characteristics	Network of open ground areas will be maintained along the lower loch shore, within planting areas and between lower and upper slopes, incorporating archaeological buffer areas. Regenerating woodland will be removed where impinging on important views and buffer areas. Re-introduction of grazing will assist in management of open ground habitats	Positive

LANDSCAPE			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Woodland expansion	Impact on wild remote open upland glen and upper slope landscapes, with respect to geomorphological features	Landscape Character Type opportunities and sensitivities have been taken into account in woodland design. Woodland expansion is limited to lower upland slopes and burn-sides; design will ensure a natural transition between wooded slopes and remote, wild uplands. Significant geomorphological features will be treated as constraints and will not be obscured by woodland planting	Positive
Woodland expansion	Retention of locally significant open ground and settings for natural and cultural features (burns, field patterns, old roadlines)	Sites identified and added to constraints maps. Relict landscapes will be retained as open ground and settings of groups of features have been respected. Construction of new path along historic road lines will retain road settings and ensure their continued preservation as historical monuments in the landscape. Features within woodland areas will be protected by unplanted buffer zones and regeneration encroaching within buffer areas will be removed. Interpretation will help develop awareness of historic and cultural context and will be explored in the Interpretation Plan.	Positive for all features
Deer fencing	Landscape impacts	To minimise the impact of fences in the landscape, fences will be routed away from skylines, follow burns and natural vegetation boundaries and be hidden at breaks of slope and using other landscape features and be set back from the Shore road. Redundant fences will be removed as soon as possible. Fencing of individual planting areas will prevent horizontal banding on slopes	Some initial local negative impacts are unavoidable; Longer term impacts are nil
Scale of proposals	Rationale for 2000 ha expansion target	Target realistic given aim of creating a native woodland resource with habitat network links within a 20 year timescale and existing landscape, cultural and physical constraints and available seed sources.	Positive

LANDSCAPE			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Paths and access routes	Visual impact	Routes, design and construction methods will use best practice to minimise visibility and landscape impacts. As dug methods will use local material to blend in. Routes will avoid long parallel allignments and use varied curves and gradients, following landform and natural boundaries where possible. Much of the new access is within woodland areas and will be hidden from long views. Skylines to be crossed at the lowest point, and steep side slopes avoided where possible to minimise cut and fill. Vegetation to be stripped and re-used on side slopes, which will be finished to a natural profile	Positive in the medium and long term, limited localised negative impacts initially.
Felling work	Visual impact	Felling will allow more natural woodland boundaries to develop in the medium and long term. Initially brash will be visible. Brash to be used where possible for ground protection. Rhododendron arisings close to roads/paths will be burnt.	Some vegetation impacts in short term. Medium and long term impacts positive
Ground preparation	Visual impact	Large areas of uniform mounds will be avoided by excavator mounding using discontinuous methods. Changes in direction of slope, travel and retention of buffer areas, wetlands and other open areas will minimise regular banding	Some impact in short term, medium and long term impacts nil

CONSERVATION- HABITATS			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Woodland expansion within overall site context	Loss or damage to non-woodland habitats	Almost all land within the site is semi-natural and much of the area is included within a priority habitat types. 2000ha of woodland expansion amounts to the actual loss of some 1000-1300 ha of open ground habitats, out of a total of some 8500ha, once open space is taken into account. Much new planting will take place on habitats that are of the least value. Priority habitats, mires and blanket bogs will be protected and remaining open ground habitats will be improved by the control of grazing pressure.	Positive at landscape scale
Woodland expansion	Habitat impacts on Blanket Bog and mire (M6, M17, M25, M23)	Woodland will not be expanded onto deep peat. Although 31% of planting land is classed as blanket bog, planting will be restricted to dry knolls. Bogs and mires will generally be retained as open space within planting areas, with the exception of lower value M25 Molinia –potentilla mire. Habitat losses will be minimal through planting, although there may be some drying out of transitional areas; Chemical application will be localised and by hand only, to minimise chemical drift and impacts on non-target vegetation; Areas of bog /mire will be avoided for groundworks, harvesting operations and paths: any negative impacts will be very local; control of grazing pressure through control of deer numbers should benefit the habitat	Positive overall, some localised unavoidable negative impacts
Woodland expansion	Habitat impacts on Upland heath (H10, H12, H21, M15)	Some loss of habitat as 31% of planting land is upland heath. Various measures will assist in improving the remaining habitat- deer populations and grazing pressure will be controlled; bracken spread will be monitored and re-introduction of cattle may assist in reducing bracken spread	Negative through loss of habitat, but remaining habitat quality is expected to be improved

CONSERVATION- HABITATS			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Woodland expansion	Upland grassland and Lowland dry acid grassland (U4, U5, CG10), Fen	Shrub depleted grassy heathland U4 and U5 account for 10% of planting land and fen for 9%. There will be some loss of habitat through woodland expansion; also reduction in overall grazing pressure and controlled grazing may assist in conversion of grassland back to heathland.	Negative, through loss of habitat, but positive for biodiversity of site.
Woodland expansion	Impacts on Species in Schedule 8 (Wildlife & Countryside Act 1981	No plants or bryophytes/fungus of local or national significance have so far been recorded.	Not significant
Conifer felling and restoration of PAWS sites	Damage to PAWS ground flora through belated or too rapid canopy removal	PAWS areas have been examined for ground flora interest. Areas with good ground flora will be retained and restored gradually to native woodland using selective and group felling over time to minimise impacts on ground flora. PAWS areas that are unstable or would become so if thinned, especially in proximity to roads, and areas with no remaining ground flora interest, due to prolonged shading, will be felled in phases and converted to native woodland using a combination of planting and natural regeneration.	Positive for remaining stable highest quality areas; positive in very long term for areas of PAWS close to roads where no ground flora exists at present.
Woodland expansion	Loss of ancient wood pasture through Inclusion within new woodlands	Existing areas will be retained and control of grazing may assist in the regeneration of moribund areas. Grazing of cattle on site will mimic some of the processes that led to the establishment of wood pasture, although a more dynamic system will be introduced – with less human intervention	Positive
Reintroduction of livestock	Potential impacts on biodiversity	Livestock grazing will be undertaken to achieve biodiversity objectives and stocking densities controlled to avoid overgrazing.	Positive

CONSERVATION- BIRDS			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Woodland expansion and replacement of open ground habitats by woodland	Impacts on protected species , including those in Annex 1 of the Wildlife and Countryside Act 1981	14 species were identified as being of particular national or international importance, out of 34 listed species of concern. Woodland expansion will lead to a loss of approximately 1970ha (equivalent to 21% of the catchment area) of open ground habitats, but these will be replaced with a variety of woodland types and densities, associated with over 600ha of internal open space and unplanted wetlands and mires. Over 6240ha of open ground habitats will be retained, much contiguous with extensive areas of open ground in neighbouring ownerships, so fragmentation is not an issue. Five of the important species will directly benefit from habitat changes, three species will be affected by loss of habitat, whilst impacts on four others are more difficult to predict. Three species may not be significantly affected.	Habitat changes positive for Bullfinch, Linnet, Song Thrush, Spotted Flycatcher and Black Grouse; negative for Skylark, Meadow Pipit and possibly Reed Bunting due to loss of habitat; unknown for Merlin, Hen Harrier and Short-eared owl, but impact probably limited due to habitat changes and possibly positive with increased prey species in long term; possibly positive for Golden Eagle with increased prey species; probably little impact on raven and curlew and peregrine.
Woodland expansion	Impacts on Golden eagle ranges and habitat suitability	Woodland expansion will be limited within areas known to be used by eagles; where trees are planted, they are to be established at very low density in line with known habitat preferences. Golden Eagles will continue to be monitored.	Probably positive due to low density planting and increased prey species.
Deer fencing	Possible bird strike by Black Grouse	All fences within 1.5km of leks to be marked with droppers. Fences will be located to avoid crossing known flight lines and will be sited away from good feeding areas; fences to be monitored for bird strike and remedial action taken	Negative impacts may occur in early years, despite mitigation. Long term

CONSERVATION- BIRDS			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
		if required. Black Grouse monitoring to continue and additional sections of fence will be marked if new lek sites come into use. Deer fences to be removed as soon as practicable.	impacts due to improved habitats are positive
Disturbance due to forestry operations	Disturbance to breeding birds by noise and activity	Known raptor nesting sites will be recorded. Forestry and path construction operations to be times to minimise disturbance to sensitive/rare species. If undertaken during the breeding season, areas will be surveyed to assess presence of protected species and measures will be taken to protect nesting sites and apply safe working distances.	None
Disturbance by walkers	Disturbance to breeding birds, particularly ground nesting birds	Known raptor nesting sites will be recorded and where safe and feasible, walkers will be forewarned or directed away during sensitive periods. Most routes will not impinge closely on Black Grouse leks and lekking times tend not to coincide with periods of use. Concentration of access is to the north of Loch Katrine, away from the most established leks. Viewing access to Culligart lek will be controlled.	Low or not significant.

CONSERVATION- ANIMALS AND INSECTS			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Woodland expansion and habitat changes	Red squirrel	Remaining main food source stands of broadleaves trees and mature conifers (Norway Spruce, larch and Scots pine) at the eastern end of Loch Katrine to be retained; relatively small percentage of large seeded species to be planted (20% oak) and the overall species mix may limit colonisation by grey squirrels. Increased woodland cover by Scots pine, and general woodland expansion will improve red habitat in the future.	Positive in short term and longer term through habitat creation. Very long term depends on grey/red squirrel population dynamics and factors outwith the ES.
Woodland expansion and habitat changes; Impacts on water quality	Otter	For water quality, the mitigation measures described in section 4.1 apply; Habitat: 50% of loch shore to remain open in potential regeneration areas and elsewhere open ground will be maintained along loch shores; water courses will be allowed to colonise naturally.	Positive
Woodland expansion and habitat changes	Pipistrelle bat	Wetland and riparian habitats providing main food sources and old trees (possible roost sites) will be maintained; possible extension of habitats	Positive
Woodland expansion and habitat changes	Water vole (if present)	Wetland and riparian habitats will be maintained; possible extension of habitats	Positive
Woodland expansion and habitat changes	Mountain hare (if present)	Grazing should lead to habitat improvement	Positive
Woodland expansion and habitat changes	Argent and Sable (if present)	Wetland habitats with Boog myrtle are not candidates for woodland expansion, but may be subject to scrub encroachment over time, grazing will help retain habitats	Unknown

CONSERVATION- ANIMALS AND INSECTS			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Woodland expansion and habitat changes	Pearl Bordered Fritillary (if present)	Monitoring will help ascertain whether species is present; proposed grazing of site and woodland management for regeneration should help retain appropriate habitat; no spraying of bracken stands in or near to woodlands to be undertaken, if dog violet is present.	Positive
Woodland expansion and management	Wood Ants	Nests will be recorded and any management work in the SSSI will take account of habitat requirements. Nests will not be marked and will not be disturbed by works. Grazing and woodland management may expand suitable habitat.	Positive
All works	Impacts of disturbance on Schedule 5 species of the Wildlife & Countryside Act 1981	Where possible, identified key species will be added to constraint maps and appropriate measures taken to protect good habitats; felling sites and watercourses will be surveyed for key species prior to work being undertaken to avoid disturbance.	None

DEER			
Issue/Subject	Impact	Mitigation	Nature of Residual impact
Deer fencing	Impacts on other species and landscape	See tables above	
Deer control	Impacts on overall deer populations and welfare	There is currently net migration into the area and grazing shortage is not an issue. Maintaining separate culling levels to the north and south of Loch Katrine, as well as undertaking some of the woodland expansion by planting within deer fences, reduces the level of culling required, but culling will help to control the deer population. Where areas are fenced, compensation culls will be undertaken. Access to lower ground for winter grazing has been maintained.	Positive

DEER			
Issue/Subject	Impact	Mitigation	Nature of Residual impact
Deer control	Impacts on neighbours	Maintaining a two area culling policy and undertaking some of the woodland expansion by planting within deer fences will ensure successful establishment and minimise the impacts on neighbouring stalking estates.	Negative, but minimised for stalking estates, positive for those with woodland expansion objectives
Deer control	Impacts on road users	Access has been left to the lochside and fencing of individual planting areas will help avoid channelling deer onto roads at dangerous locations.	Positive
Deer control	Impacts on visitors	Culling policy and intention to cull in season in North Loch Katrine will help to maintain deer populations on site for visitors to see and avoid disturbance to visitors during the main tourist season.	Positive
Deer control	Impacts on habitats	Open ground habitats will be monitored to ensure that control policy benefits the condition of key habitats.	Positive

ARCHAEOLOGY			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Woodland expansion around archaeological features	Damage to features or loss within woodlands	The area of potential woodland expansion has been surveyed and all archeological remains recorded on constraints maps. Most features are excluded from planting areas. Remains that fall within planting boundaries will be protected by unplanted buffer zones extending to 20m for sites or 8-20m for linear features. Sites within woodland regeneration areas will be monitored for encroaching regeneration and buffer zones will be kept clear where this occurs.	Positive

ARCHAEOLOGY			
Issue/ Subject	Impact	Mitigation	Nature of Residual Impact
Setting of archaeological features	Potential loss of cohesion of the relict landscape, where features are obscured or isolated by intervening woodlands	Planting areas boundaries have been amended to exclude relict field patterns and associated remains of settlements. Woodland boundaries lie above main concentrations of remains. Sites enclosed by woodland will be buffered and if more than one site occurs, they will be buffered together. Features along loch shore will be retained within open ground. Other sites will be monitored Opportunities will be taken to interpret some of the better preserved relict areas, where these coincide with roads and paths.	Positive for post medieval remains
Woodland expansion	Significance of the Historic Land Use will be lost	Much of HLUA areas of interest are the existing woodlands – which will be protected and interpreted. Relict settlement patterns (as identified by remains) have been excluded from planting areas, and additional relict areas identified through site surveys. Of the areas identified as medieval grazing, only the boundaries remain. These will be protected and the proposed tree cover within these will be at very low density	Positive for post medieval remains;; Medieval boundary features will be retained, with part of area under low density trees.
Felling, ground preparation and pathworks	Damage to archaeological features	Sites will be located and marked in advance of works being undertaken and avoided for working purposes wherever possible, with trees felled away from remains. Path lines, management and extraction routes will be chosen to avoid archaeological sites. In cases where contact with a site is unavoidable, all possible measures will be taken to protect remains e.g. use of brush mats, and the regional archaeologist will be consulted before work is undertaken. Any additional sites identified during work will be recorded and added to constraint maps	Positive

DISCUSSION OF RESIDUAL IMPACTS

Once mitigation measures have been implemented, the overall project impact will be as follows:

POSITIVE IMPACTS

- Conservation and management of both open ground habitats and woodlands
- Expansion and creation of new landscape scale native woodland habitats providing habitat links with native woodland to the east and west and developing the forest habitat network envisaged for the National Park.
- Improved access within the site for walkers, cyclists and family groups, to complement the all abilities access provided by the Shore road and provide alternative short routes which will open up new viewpoints at various locations around lochs Katrine and Arklet.
- The establishment of a new off-road route connecting the existing road around Loch Katrine to neighbouring settlements and tourist destinations, and providing linkages to long distance routes such as the West Highland Way, and forest road and access networks within Loch Ard Forest
- Potential for establishment of a through route from the slopes of Ben A'an to the east, connecting to forest road and access networks within the Queen Elizabeth Forest Park and Glen Finglas and NCR7
- Conservation and protection of important archaeological features and their settings, with improved access opportunities for the public providing new opportunities for interpretation and engagement with the cultural and historic past.
- Long term protection and stability of slopes within the public water catchment .
- Positive contribution to key objectives of the Loch Lomond and Trossachs National Park Local Woodland and Forestry Framework strategy (2003) and other LL&TNP policies.
- The native woodland habitat creation will benefit and stabilise populations of most mammals present on the catchment.

NEGATIVE IMPACTS

- Sections of deer fences will be visible at some locations during early years of establishment and detract from the wild image of the area.
- Limited sections of new pathworks may be visible in early years, until revegetation occurs.

- Possibility of bird strike on deer fences.
- Some bird species will be negatively affected through removal of open ground habitat.
- Establishment works will be visually intrusive during early years.
- Some disturbance to ground conditions and drainage by machines is inevitable during felling, ground preparation and path works.

UNCERTAIN IMPACTS

Long term impacts on some bird species such as Reed Bunting and some raptors are unknown, although not necessarily negative

ACKNOWLEDGEMENTS

We would like to acknowledge help at the scoping stage and input by the following individuals and organisations with thanks:

Duncan Cameron, RSPB
 Nick Chambers, RSPB
 Angela Douglas, Woodland Trust Scotland
 Graham E Ellis, SS Sir Walter Scott
 Allan Fail, Scottish Water and Loch Katrine Community Trust
 Sandra Hanlon, FCS
 Francis Hayes, SEPA
 David Jarman, Mountain Landscapes Research
 Peter Kirk, Deer Commission Scotland
 Russell Lamont FCS
 Kate Longworth, Loch Katrine Community Trust
 Mike Luti, Callander Community Council and LL&TNP
 Alan McDonnell, SNH
 Iain Mc Nicol, FCS
 Leslie Mickethwaite, SS Sir Walter Scott
 Grant Moir LL&TNP
 Bill Raynor, FCS
 Adam Wallace, Woodland Trust Scotland
 Simon Zisman, RSPB
 Strathard Community Trust
 Central Environmental Services
 Trossachs Community Council
 Headland Archaeology Limited

1. INTRODUCTION

1.1 Location of the Site

The Loch Katrine catchment area is located in the heart of Loch Lomond & The Trossachs National Park, 14 km due east of Callander and 17km north west of Aberfoyle. The area is located on OS 1:50,000 Landranger Map Sheets 56 and 57.

Covering 9597ha of land, the area is defined by the ridges which connect a number of hill and mountain peaks surrounding Lochs Katrine and Arklet. These include Ben Venue and Ben A'an at the eastern end of Loch Katrine, leading via Cnoc Odhar and An Stuchd up to Stob A'Choin which at 869m is the highest peak on the northern boundary. From here the boundary leads westwards to Parlan Hill marking the north-western extent of the site. Beinn A Choin and Stob an Fhainne to the west of Loch Arklet mark the western boundary and Cruachan the south-western point. From Cruachan the boundary leads eastwards to Beinn Uamha, drops down to cross the B829 along the Loch Ard forest boundary and then rises via Caistal Corrach to Bheinn Breach and back up the ridge to Ben Venue.

The site is bounded by the Forestry Commission Scotland's (FCS) Queen Elizabeth Forest Park and Loch Ard Forests to the south, Garrison Farm and Inversnaid on Loch Lomondside to the west, which are owned by the Royal Society for the Protection of Birds (RSPB); Glen Finglas to the north east, owned by the Woodland Trust (WT) and private estates to the north and the north east. (see Location Map 1).

Loch Katrine and its surroundings have long been recognised as one of the outstanding scenic areas of Scotland and in addition to the recreational and landscape benefits they provide, Loch Katrine and Loch Arklet are of vital public importance, having been Glasgow's main source of drinking water since the mid 19th century.

1.2 Background to the Site

The Trossachs and Loch Katrine have played a significant role in the history and literature of Scotland. Made famous through its connection with the historical figure of Rob Roy McGregor and the writings of novelists and poets, the romantic and picturesque landscape of the area has been a draw to tourists since the early 18th century. Since 1859 the area has been important in supplying water to the city of Glasgow.

1.2.1. Management for water supply

The catchment became of strategic public significance in 1859 when following the construction of a dam to raise the loch level, 11 miles of tunnels, 26 miles of aqueducts and trunk mains and a storage reservoir at Milngavie, Loch Katrine became the source of high quality raw water for the rapidly expanding city of Glasgow.

Maintaining this water supply has been the primary focus of management of the estate since this time, with further improvements made to the system in the 1890's and early 20th century, when Loch Arklet was developed as a feeder loch to Katrine. Ownership of the estate passed through various bodies and came into public ownership in the early 20th century. More recently, responsibility for the site has passed from the West of Scotland Water Authority (WoSW) to Scottish Water (SW), following the amalgamation of three water authorities in 2002.

Under WoSW, in addition to the core activity of water supply and treatment, the estate was managed for tourism (with the operation of the Sir Walter Scott steamer and refreshment facilities); agriculture, with around 8000 sheep; forestry; fishing and to a lesser extent stalking and grouse shooting. Moves to better integrate these activities started in the 1990's.

During recent years, the issue of water quality has received much attention, with The EU Drinking Water Directive of 1988 and Water Supply (Water Quality) (Scotland) Regulations 2001, setting new standards and parameters for quality. At the same time the requirement to monitor, assess development impacts and set measures to improve the environmental quality of inland surface water resources were placed on those managing such areas by The EU Water Framework Directive 2000.

The tightening of regulations relating to microbial content of drinking water, necessitated the removal of livestock and suspension of grazing activities pending the construction of new filtration facilities at Milngavie. Sheep were removed from the catchment in 2002. The new treatment facility is currently under construction and is due to be completed in 2007. The re-introduction of livestock to the area can be considered once works are operational.

1.2.2 Integrated Catchment Management

The various regulations also required that the environmental condition of the catchment, land use activities and their management all be re-evaluated and it was recognised that this could best be achieved through the development of an Integrated Catchment Management Plan (ICMP). This plan, which entailed extensive consultations with interested local individuals and organisations was commissioned in February 2001 and published in November 2001.

The plan provided an assessment of the resource and identified the interactions between the supply of water and the traditional land uses of farming, forestry and tourism. It acknowledged that these could place pressure on a fragile environment, where the protection of water is paramount. It also concluded that for management purposes, the water authority should concentrate on water supply issues, with responsibility for the land surrounding Loch Katrine, and the tourism facility, the Sir Walter Scott, devolved to third parties. Three bids to manage the property were considered, which resulted in Forestry Commission Scotland (FCS) achieving 'Preferred Bidder' status. Under the FCS bid the tourism facilities were to be managed by a separate entity, the Walter Scott Trust, whilst FCS would be responsible for the management of the land within the catchment.

1.2.3 Current site management

Following two years of discussions and negotiations between SW and FCS, an agreed lease was signed on the 27th March 2005, with Scottish Water and the Scottish Ministers as signatories.

The term of the lease is 150 years (with a further 25 years committed to similar management) and covers a land area of 9597 hectares. Under the lease, FCS has taken on the commitment to deliver the ICMP objectives, one of which is to increase the native woodland within the catchment. The lease also required that FCS produce an Interim Management Plan (IMP) for the estate (see Appendix 2). Following consultations with SW, the IMP would be amended to become the Management Plan for the site. The proposals included in this Environmental Statement are the revised proposals as agreed by SW.

In tandem with revision of the IMP, a number of surveys have been commissioned. These include landscape assessments from a number of key viewpoints; a moorland bird survey; an additional archaeological survey; an NVC survey of land with woodland expansion potential and soil survey of proposed planting land. Proposals for paths and woodland expansion as detailed in the IMP (November 2006 revision) have been amended in the light of the additional information obtained and these amended proposals are used to describe the scheme objectives in section 1.3.

1.2.4 Past woodland work

Areas of broadleaved woodland have existed around the catchment since pre-1860. Modern commercial forestry became a component of the estate from the 1920's with the establishment of well over 200ha of conifer plantation over the next 20-30 years.

Under WoSW a programme of exotic conifer plantation removal had been started, to benefit both water supply and the landscape of the catchment. By the late 1990's there was an estimated 1203ha of woodland, including approximately 200ha of commercial woodland remaining.

An Environmental Statement was prepared in 1997 for a Woodland Grant Scheme which covered some 713ha of woodland work. This included management of over 400ha of existing woodland by stock exclusion to allow natural regeneration, 94ha of conifer felling at Schoolhouse and Primrose Hill; and expansion of native woodland through replanting, natural regeneration and new planting whilst improving woodland boundaries at these and other locations around Loch Katrine. By 2001, the majority of works had been undertaken or started, but survival of trees within planted areas was variable. Under the 150 year lease, FCS accepted responsibility for 210ha of restocking, regeneration and new planting at Stronachlachar, Schoolhouse and Primrose Hill . Completion of felling work and replanting at Schoolhouse is included within the IMP and forms part of this ES. Work in these areas is ongoing, but affected areas have been included within current plans to provide a full picture of proposed plans for the area.

1.3 Objectives for the Land

The primary aims for the site are stated in the IMP and cover four areas: woodland, farming, tourism and conservation. Some of these are broad aspirations, or relate to the longer term situation or working arrangements for the site. Other objectives are more specific and directly relevant to this ES.

Woodland Objectives

- Retention of existing water quality.
- Active management of the existing woodlands
- Expansion of the existing native woodland area
- Creation of a native woodland corridor and linkage from Glen Finglas to Loch Lomond to integrate with the Loch Lomond and the Trossachs National Park's Woodland Framework.
- Increase in the floral and faunal biodiversity of woodlands
- To reduce deer numbers to sustainable levels

Farming Objectives

- To ensure that the water quality of Loch Katrine and Loch Arklet is retained.
- To reduce grazing to a level which allows the maximum area of native woodland for planting/natural regeneration
- To retain sufficient area of grazing to allow the retention of an economically viable farming operation.
- To reduce grazing pressure within the agricultural area to maximise biodiversity.

Tourism Objectives

- To retain the existing water quality.
- To allow open access for the general public and to create new access to be sympathetic to the landscape and integrate with other recreational providers.

- To develop linkages with FCS Queen Elizabeth Forest Park, National Park, West Highland Way, National Cycle Network and other rights of way and neighbouring estates.
- Other longer term objectives which are not directly relevant to proposals covered by this ES include the development of an Interpretation Plan; development of a close working relationship with the Sir Walter Scot Trust in order to identify opportunities for joint visitor enhancement; development of Eco- tourism within the catchment and working with the Community to ensure they can benefit from the increased visitor's numbers.

Conservation Objectives

- To develop woodland and bio-diversity targets by which management regimes can be assessed.
- To reduce grazing density to allow the development of the natural flora.
- To manage old growth stands with a minimum of intervention.
- To allow the development of a full altitudinal range of native woodlands.
- To restrict native woodland establishment to very low densities within ornithologically sensitive areas
- To contribute to development and delivery of the objectives within the LL&TNP draft plan, the UK Bio-diversity Action Plan and Scottish Wildlife Trust Sites.
- To explore and develop opportunities to augment deadwood.
- To look for opportunities to restore ancient woodland sites previously planted with conifers.
- To remove non-native and invasive species such as Sitka spruce and Rhododendron
- To survey and safeguard the cultural heritage sites located within the catchment.

1.4 Works Proposed under this Environmental Statement

Works proposed in the revised IMP and covered by this document are listed below. Original proposals made in the IMP have been modified as a result of consultations and recent site investigations. Although new planting is still located mainly in the same indicative areas, boundaries have been altered considerably. A number of access proposals have also been dropped. These included an access road development along the south side of Loch Arklet and the Edra footpath loop. Current proposals are shown on Map 6 Woodland Proposals and Map 5, Access Existing and Proposed.

- Management of 220ha of SSSI and up to 384ha of other ASNW areas, including the removal of 105ha of non-native conifer plantation and restoration of these areas to native woodland

- Long term retention of 17ha of conifer of importance as a food source for red squirrels and expansion of natural Scots Pine woodland type where appropriate to expand the prime habitat for this species.
- Expansion of native woodland by 800 ha of new planting (net area) over 5-8 years and a further 560ha natural regeneration (net area) over 20-30 years to create strategic and essential links to local habitat networks and create core woodland areas for species to colonise and move through.
- To buffer existing woodland habitats in the face of possible climate change; to link existing fragmentary habitats and provide maximum potential for species movement and interaction
- To maintain the slopes below Ben Venue to the Creag Damh/Glasahoile woodlands (around 74ha) as a Natural Reserve or Wilderness area (i.e. no improvements to access and no anticipated intervention, other than removal of invasive non-native species).
- To improve access provision within the catchment by the creation of 5450m of new paths at Primrose Hill, Schoolhouse, Stronachlachar and Culligart which will open up in excess of 10,000m of new or improved access, including 420m of new all abilities path.
- To improve strategic access links to neighbouring land and recreational facilities by the creation of 9800m of new paths providing links to Inversnaid on Loch Lomondside and Loch Ard Forest, and 1140m at Ben A'an to connect to neighbouring FCS access networks in The Groddach block (subject of an ongoing ES), with potential links to various long distance routes to the east and south-east.
- To manage deer numbers to achieve woodland expansion objectives, to exclude deer from new planting areas and to allow continued grazing of open ground habitats to benefit biodiversity
- Where expansion is likely to impact on key species such as eagles and black grouse, to minimise any adverse impacts
- To implement an annual programme of rhododendron control to contain the spread of the plant (the total area of Rhododendron in the catchment is currently estimated at 80ha).
- To assess impacts on key habitats and species of interest and implement monitoring regimes to assess impacts of management. These include: Blanket bog; Upland heathlands; Upland grassland and lowland dry acid grassland; Alpine and boreal grasslands; Fen; Wet woodlands and Upland oak woodlands, as well as various bird, mammal and invertebrate species.

1.5 The Environmental Statement

An Environmental Statement is required by the Forestry Commission under the Environmental Impact Assessment (Forestry) (Scotland) Regulations 1999, to address the impact of proposals for the Loch Katrine catchment on five areas:

1. **Public water catchment:** Loch Katrine is the main source of raw water for Glasgow. It is essential that proposed activities within the catchment have no detrimental impact on water quality.
2. **Landscape:** Loch Katrine is an important tourist attraction within the LL&TNP, with over 180,000 visits a year. Many of the visitors take steamer trips or use the shore road, from which vantage points much of the catchment area is visible. Loch Katrine is valued and visited for its landscape and it is essential for the prosperity of not only the local area, but for the National Park as a whole, that proposed woodland expansion is in sympathy with the romantic character of the Trossachs. The whole area is included within an Area of Great Landscape Value
3. **Conservation:** The site includes four Scottish WildlifeTrust Sites, woodlands of designated national and European importance – part of the Ben A’an and Brennachoile Site of Special Scientific Interest (SSSI) which in turn form part of the Trossachs Special Area of Conservation (SAC) as well as key habitats and species of local and national importance.
4. **Deer:** Management policy for deer will affect the success and visual impact of proposed woodland expansion, as well as surrounding areas and neighbouring estates, some of whom rely on stalking.
5. **Archaeology:** within the 350m limit to potential woodland expansion of the lease area, there are 166 recorded features or grouped features of local archaeological interest, which need to be protected as a record of the cultural history of the site. Some features are sufficiently interesting in a historical context to contribute directly to the visitor experience and are part of the draw of the site to visitors.

This Environmental Statement aims to identify the environmental impacts of proposals for woodland expansion, deer control and recreational path and road development on these five areas. It will illustrate how woodland and path design and methods used to implement proposed works will take account of these impacts and seek to mitigate any potential negative impacts. Technical terms found within this document are listed in the glossary (Appendix 15), and a full bibliography of literature used can be found in Appendix 16.

1.6 Scoping Meeting

In accordance with the usual Forestry Commission Scotland procedure, a scoping meeting of statutory bodies and interested parties was held on 26 May 2006.

Proposals made in the IMP were presented and discussed. The meeting was attended by representatives of the local community, local business, neighbouring landowners, conservation organisations and statutory authorities, representing a wide range of interests. In addition a number of detailed written responses were made. A copy of the scoping report is contained in Appendix 1.

2. SITE DESCRIPTION

2.1 General Description

Loch Katrine and its surroundings exemplify the wild, rugged landscape of loch, hill and woodland for which the Trossachs are famed. The catchment of 9597ha encloses 2 lochs extending over some 1520ha, the surrounding hill slopes, and significant areas of upland. The leased area excludes the two lochs and islands, Stronachlachar village, land at Glasahoile, residential properties around the lochs and properties associated with the water supply network.

Loch Katrine is approximately 14 km long and 1.5 km wide and is orientated east-west along much of its length through Strath Gartney. At the western end, the valley is forced north-westwards around the lower flanks of Cruinn Bheinn and An Garadh, whilst to the east it runs south-eastwards to pass between rocky masses of Ben A'an and Ben Venue to its outfall, the Achray Water. The wider catchment is defined by a string of ridges, peaks and rocky hilltops ringing the loch, generally at a distance of 1-2km from the shoreline, although along the north of the loch, below Stob a' Choin and Beinn Breach a far more extensive area of upland is enclosed. To the south east, inclusion of the upland mass lying between Lochs Katrine and Arklet extends the distance between boundary and loch shore to 3-4km .

Loch Katrine is fed by Glengyle Water from the north-west, as well as numerous small tributaries and burns, the majority flowing down deep gullies cut into the hillsides. Watercourses entering Loch Katrine from north tend to be larger as they drain a greater expanse of land. Main tributaries include: Allt a' Choin, Strone Burn and Letter Burn from the north and Culligart and Allt Glasahoile from the south. Some of these burns arise in small elevated lochans.

Loch Arklet (around 4km long and 0.5km wide) runs east-west along the length of Glen Arklet. This glen joins Strath Gartney along its southern edge, at the point where the main valley begins to turn to the north-west, and is separated by a col of low-lying land, close to the village of Stronachlachar. Loch Arklet is also fed by numerous small burns running down the steep slopes above the glen. To the north, the valley enclosing the Corriearklet burn bisects the ridgeline above Glen Arklet.

A large car park, café, bike hire facilities and the Trossachs pier are located at the eastern end of the loch. These are accessed from the A821, which connects the settlements of Brig o' Turk and Callander to the east with Aberfoyle to the south. From the Trossachs Pier, a private tarmac road follows the shoreline of Loch Katrine closely for some 22km around to Stronachlachar on the south-western shore. This road is an important management access, as well as servicing private houses at Brenachoile, Edra, Letter, Portnellan, Glengyle and the Dhu and Stronachlachar village and pier. It also provides access for walkers and cyclists visiting the area. From Stromachlachar Pier, the private road extends a further

2.5km east, to the waterworks at Royal Cottage, whilst a public road leads west, running along the northern shore of Loch Arklet to terminate at Inversnaid on Loch Lomondside. Just to the east of Loch Arklet the Inversnaid road joins the B829 Aberfoyle road.

For the purposes of description and the ES, the following areas within the catchment have been differentiated (see Katrine Areas Map 1b):

Ben A'an SSSI: includes the top and wooded slopes of this hill which extend down to the lochside and car park, as well as the low lying area between the Trossachs Pier road and the Achray Water, known as Craig Levan and the Am Priosan headland. Part of the SSSI on adjacent FCS land and the islands is excluded from the lease area.

Ben A'an area: this applies to the woodland and conifer plantations located to the north of the Ben A'an SSSI boundary.

Silver Strand: the lochside area adjacent to the Ben A'an plantations.

Primrose Hill: includes the largely wooded south-west facing slopes below 350m above Loch Katrine, enclosed within a deer fence. The area lies between Silver Strand to the south and extends above the lower slopes around Brenachoile to the woodland boundary below Bealach na h-Imriche. The area around Brenachoile is not part of Primrose Hill.

Brenachoile: the SSSI woodland around Brenachoile point and lodge and non-SSSI woodlands along the lochside to the east and west of the SSSI.

Letter: land to the east of Letter burn and west of Primrose Hill. The area extends above the western Brenachoile woods.

Edra: currently open land to the north of the steading and west of Letter burn

Strone: currently open land above the steading, on both sides of the Strone Burn (Strone east and Strone west), and the area of woodland along the lower slopes of the loch and to the west of the steading (Strone Woods).

Schoolhouse: The area of mainly existing conifer and new plantation around the point below the burn running south from Cruinn Bheinn, where the old schoolhouse was located. The area is defined by an existing deer fence.

Coilachra: the existing native woodland area along the Shore road to the east and west of Coilachra steading

Allt a Choile: proposed new woodland areas to east and west of the burn.

Portnellan: existing native woodlands around this steading and new planting area to north-west.

Boathouse Wood: the woodland lying between the Boathouse and Glengyle House which includes both broadleaves and conifer plantation

Glengyle House: existing native woodland to the west of the house and proposed new planting above this. Also conifer areas either side of the road at this location.

Glen Gyle north: slopes to the north of the Glen Gyle Water

Glen Gyle south: slopes to the south of Glen Gyle Water and above the Dhu steading

Maol Mor: partially wooded north-east facing slopes of Loch Katrine, below Maol Mor

Stronachlachar: recently established woodland on north-east, east and south-east facing slopes below Garradh. This includes land planted under the 1997 Woodland Grant Scheme (WGS) and still in its establishment phase (Stronachlachar WGS) and the proposed new planting area adjacent to this (Stronachlachar extension)

North Loch Arklet : Land to north of Loch Arklet, divided into areas east and west of the Corriarklet valley and the central area, within the Corriarklet vally.

South Loch Arklet: Land to the south of Loch Arklet, divided into areas east and west of Corriachan.

East Loch Arklet : Lowland area to the east of the loch, west of the point at Ruha Saonach.

Royal Cottage: land and woodland to the south-west of this Royal Cottage and the Aquaduct inlet.

Culligart: land to south of this steading and along the Culligart Burn, extending up to Caisteal Corrach:

Coille Mhor: land between Culligart to the east and Allt Glsahoil/Beinn Breach to the west

Glasahoile: woodlands and open land around Glasahoile on the lower loch shore slopes, including some 1997 WGS woodland expansion. An area of open land lies outwith the lease area.

Wilderness: land above Glasahoile woods and on the slopes below Ben Venue.

2.2 Policy Context, Statutory and Other Designations

The area includes or is affected by a number of designations as well as policies relating to various issues.

2.2.1 Loch Lomond and Trossachs National Park (LL&TNP) Policies

The catchment is located at the heart of the National Park, which is now the planning authority. LL&TNP aims include: “to conserve and enhance the natural and cultural heritage of the area” and “to promote sustainable use of the natural resources of the area”; which have a direct bearing on proposals for Loch Katrine. The LL&TNP draft plan contains a number of policies directly related to proposals covered by this ES. These relate to landscape; cultural heritage; biodiversity and geology; water management and fisheries. Those most directly relevant are listed below.

LS2: Open landscapes of upland glens, ridges and summits – to preserve and enhance these open landscapes and ensure an appropriate balance between issues of biodiversity and landscape. Also to ensure that new woodland does not obscure cultural features or detract from the open character of these areas.

LS3: Open landscape spaces, glens and lowlands – to preserve and enhance important components such as fields and clearings, to safeguard the predominantly open qualities of glen and strath floors and maintain an appropriate balance of woodland and open space on glen slopes.

LS5: Felling - to minimise negative impacts of felling.

LS7: Native Woodlands and Landscape Qualities - to undertake local landscape assessments where expansion is proposed and support the management of diverse native types and encourage restoration of Planted Ancient Woodlands (PAWS).

LS10: Historic Landscapes - to safeguard relict landuse patterns and remains of historic landscapes.

LS13: Historic Communication Routes and Traditional Roads - to retain and enhance remnants of historic communication routes and promote understanding of their purpose.

LS14: Visual and Scenic Quality – to protect areas from inappropriate or insensitive landuse change including hill tracks and deer fences.

LS17: Views from the road – to allow sequential movement through landscapes and improve visual and physical relationships.

LS19: Wildness and Remoteness – to avoid development which interferes with these qualities.

CH2: Caring for Archaeological sites, settings and landscapes – to demonstrate good practice

BD1: Strategic approach to Biodiversity Enhancement - to take landscape scale approach and enhance habitat networks.

BD4: Other plans and Strategies – to ensure that these include management objectives for biodiversity.

BD5: Improve Knowledge and Monitoring

BD8: Designated Sites – to safeguard and enhance designated such as SSSIs, SACs.

BD9: Management and Protection of Non-Designated Habitats – to protect important habitats such as ancient woodlands, blanket bog and wetlands.

BD11: Non-Native Species – to limit impacts of potentially damaging species.

BD13: Upland and Woodland Grazing Management – to promote grazing at appropriate intensities and use as a conservation tool.

BD15: Forests, Woodlands and Biodiversity – to create a functioning forest habitat network and promote more natural woodland scrub layers through grazing.

BD17: Water Management and Biodiversity – to safeguard and enhance aquatic habitats (including lochs, rivers, riverbanks and wetlands).

G1: Geological Landscape Features – the key geological and geomorphological landscape features that contribute to the landscape will be safeguarded.

WM1: Water framework Directive – to ensure a catchment based approach to water management.

WM3: Nutrient levels – to prevent or minimise nutrient inputs and their adverse impacts.

WM4: Land Management Practices and Water Resources – to promote agricultural and forestry practices which conserve and enhance soil and water resources.

FM5: Fisheries – to promote positive management of riparian habitats.

2.2.2 Strategic Forestry and Woodland Policy Context

The Loch Lomond and the Trossachs Forest and Woodland Framework:

This document sets the vision for woodland and forestry in the National Park (NP) and provides non-statutory guidance on how these can contribute to NP aims. The catchment area falls within Action Area 8 (Strath Gartney and the Braes of Balquhidder). The framework identifies potential in this area for restructuring of conifer plantations and major expansion of native woodland and of oakwoods and birchwoods as priority woodland habitats. Woodland regeneration along main and tributary glens provides opportunities to create key forest habitat network links to the Loch Lomond woodlands to the west, Glen Falloch to the north-west and Strathyre and Loch Earn to the east. Woodland expansion up slopes provides opportunities to re-establish natural woodland transitions from valley floor to open moorland.

In addition woodland expansion provides opportunities for improvements to water quality and enhanced public access in the form of new links and loops (family routes) to complement upland walking routes.

Indicative Forestry Strategy (IFS)

The Clackmannanshire and Stirling Structure Plan's IFS provides a strategic overview of woodland and forestry potential in the area and identifies four land categories in terms of woodland expansion; preferred, potential, sensitive and unsuitable. The IFS indicates that most of the catchment area falls within land zoned as "potential" for woodland planting. Areas identified as unsuitable include the rocky tops of Maol Mor and Beinn a Choin in the south-west of the catchment; whilst the slopes below Ben Venue and Beinn Breach in the south-east are designated as sensitive. This coincides with the National Scenic Area designation (NSA - see below) All areas proposed for planting or regeneration under ES proposals lie within land zoned as "potential".

2.2.3 Landscape Designations

Area of Great Landscape Value (AGLV):

The whole site lies within an Area of Great Landscape Value (see Landscape Constraints Map 2).

National Scenic Area (NSA):

The catchment is affected by two designated National Scenic Areas. The extreme east of the area falls within the Breadalbane NSA, whilst the western end of Glen Arklet falls within the Loch Lomond NSA (see Map 2). These recognise the landscape value of the area, but have been largely superseded by the National Park designation.

2.2.4 Conservation Designations

Scottish Wildlife Trust (SWT) Wildlife Sites – non statutory designation:

SWT have surveyed and identified four Wildlife Sites. These include Glen Gyle Birchwood, Meall Dearg, Strone Burn and Letter Burn.

Glengyle Birchwood WS covers an area of 198.8ha and is an ancient woodland site comprising downy birch dominated woodland with a very open canopy which is interspersed with a mosaic of marshy grassland, a large area of acid grassland and an area of fen. The area was identified as being in need of management.

The Meall Dearg WS covers an area of 166ha and has a rich diversity of habitats ranging from hill top mire, through heath, flush, marshy grassland down to various woodland types on the shoreline.

Strone Burn WS covers an area of 81ha and principally comprises a large area of ancient woodland together with gorge woodland rich in pteridophytes, particularly oceanic species, and species diverse woodland burns. It also includes various moorland habitats within the surrounding area.

Letter Burn WS covers an area of 26.8ha and comprises a fast flowing hill stream running through a wooded gorge rich in herbs, ferns and bryophytes. The site also includes an extensive area of dry heath/acid grassland.

Ancient Semi Natural Woodland (ASNW) – non-statutory designation:

Within the catchment there is 890ha of native broadleaved woodland as mapped from aerial photographs. Much of this, 604ha, is considered to be Ancient Semi

Natural Woodland (ASNW), with most of the land having been under continuous woodland cover since at least 1750. A relatively small area of woodland, developed between 1750 and 1860, is represented by woodlands located on the southern side of Glen Arklet and up the Allt Glasahoil burn, with a small area located within the Ben A'an SSSI (see below). Commercial conifer plantations established from the 1920's, were planted on higher land, but also on some of the ASNW woodland area. Currently conifer plantation occupies some 65ha of Ancient Woodland sites, classed as Planted Ancient Woodlands (PAWs).

Site of Special Scientific Interest (SSSI):

There is one Site of Special Scientific Interest (SSSI), designated under the Wildlife and Countryside Act 1981. This covers 263ha of woodland located on the slopes of Ben A'an and around Brenachoile point. 222ha of this site lies within the lease area, (26ha at Brenachoile and 196ha at Ben A'an), with the remainder on adjacent FCS land, or located on islands retained by Scottish Water. The woods were designated as they represent an exceptionally extensive area of semi-natural deciduous woodland of largely ancient origin, forming one of the largest and most diverse woodland complexes in the (then) Central Region. The woods are classified as "old Sessile Oak woods (*Quercus petraea*) with *Ilex* and *Blechnum*". This site is subject to management restrictions and management plans have to be agreed by Scottish Natural Heritage. The current plan is for the period 2005-2010.

Special Area of Conservation (SAC):

The Ben A'an and Brenachoile woodlands together with the Craigmore and Cuilvona Woods SSSI were designated as a Special Area of Conservation (SAC) in 2005 under the European Habitats Directive (2000) and now constitute a Natura 2000 site.

EU Habitats Directive, UK Biodiversity Action Plan (UKBAP) and Local Biodiversity Action Plans (LBAP):

The catchment contains a number of Important habitats and species as identified in Annex 1 of the EU habitats Directive 1992 (Council Directive 92/43/EEC) and included in the UKBAP and LBAP as priority habitats and species. It also supports bird species that are listed in Annex 1 of EC Directive 79/409 (Birds Directive). There is a requirement to have a regard to these habitats and species when undertaking works likely to impact upon them and to seek to mitigate these impacts where possible. The UKBAP places habitats and species in a national context, whilst the Stirling Council LBAP accords local significance to the priority habitats and species.

2.3 Climate

Prevailing winds are south-westerly and the climate is relatively wet. Rainfall averages 2232mm and 2361mm over the Loch Katrine and Loch Arklet catchments

respectively (SAAR standard average rainfall figures 1961-1990). The driest period is from late spring to early summer. Some precipitation falls as snow, although for the past 10 years there has been no appreciable snowpack formation at higher elevation. Exposure varies from sheltered to severe, increasing with altitude. Average temperatures (LL&TNP area) reflect the oceanic influence and range from around 3.7° C in December and January to 14° C in the summer, although this decreases with altitude by around 1° C for every 150m. Climate change predicts a rise in average temperatures of 1.2-2.6° C by the end of the century with higher rainfall and a reduction in both the area affected by snowpack and the length of time for which this is present.

2.4 Elevation and Aspect

The lowest parts of the land area of the catchment are at the western end of Loch Arklet, south of Garrison; and the eastern end of Loch Katrine by the car park at around 130m AOD, although the loch floor is over 140m deep in places. The flattest area of land is the low lying area located around Stronachlachar and to the east of Loch Arklet. The peaks and ridges surrounding the lochs generally lie between 500-750m, with the highest continuous ridges along the north of the catchment. These rise up to Stob a Choin, the highest point within the catchment at 865m AOD. South-east of Stronachlachar, the ridges rise gradually up to Ben Venue (727m), before dropping steeply down to the Achray Water.

The dominant aspects within the catchment are north/ north-westerly and south/south easterly, although side valley slopes present a range of other aspects.

2.5 Geology

The underlying solid geology of the area consists mainly of relatively impermeable metamorphic rock of the Dalradian series, of intermediate or acid chemical types. The rocks were formed by intense heat and pressure acting upon earlier sedimentary rock and in some areas are overlain by a mantle of moraine and drift material left by retreating glaciers (evident as hummocky terrain on some lower valley sides). There are broadly three types of bedrock. The whole Loch Arklet catchment and the west of Loch Katrine catchment from Brenachoile on the north shore and Glasahoile on the south is underlain by the quartz-mica-schists, grits, slate and phyllites of the Ben Ledi Grit formation. To the east, the area is mainly underlain by highly resistant schistose grits and greywacke, which appear on the tops and upper slopes of Ben Venue and Ben A'an. Around the Letter area, and also occurring as parallel bands within the eastern area, are epidote-chlorite-schists, also known as Greenbeds due to the high proportion of the mineral hornblende, which gives some rocks a greenish coloration. These consist of metamorphosed sandstones and

siltstones, are very resistant to weathering and often outcrop as bare rock, lacking a covering of soil.

2.6 Soils

The chemical nature and relative impermeability of the underlying geology, in addition to the wet climate are responsible for the soils that have developed over the slopes around the lochs. The soils are of variable depth, but those developed over rock are generally acidic, contain high proportions of sand and silt and are prone to leaching. At higher altitudes or where slopes are shallow, organic surface layers have accumulated, forming extensive areas of blanket bog. There are numerous outcrops of parent rock, often becoming extensive at higher elevations. Areas of moderately basic soils are rare in the catchment, and are confined to a few gullies and talus slopes.

The soils are all associated with the Strichen Association (Soil Survey of Scotland 1982). The soil maps of planting areas (see Appendix 12 ESC Analysis) show these areas to consist of complex associations of soil types, depending on altitude, local aspect and drainage. These commonly include brown earths, leached soils such as podzols and ironpans, surface water gleys and peaty gleys where vertical drainage is impeded and peats in areas of very poor drainage and over shallow slopes of less than 12 degrees.

Soils developed over till, moraine and colluvium contain a similar mix of soil types, although where indurations occur, they tend to be at greater depth. Deep peats are found in hollows between the humic ironpans and podzols that have developed on better drained areas and gleys, where vertical movement of water is impeded by impermeable layers beneath.

2.7 Geomorphology and Topography

The Katrine and Arklet catchments contain a number of features of geomorphological interest. These help interpret the history of the landscape and would be less obvious if they were allowed to disappear beneath dense woodland cover. Of particular interest are the post glacial landscape and more recent evidence of large scale rock slip failure.

2.7.1 Glacial features

The topography of the area has been much shaped by glacial influences, with Loch Katrine lying within a glacially eroded valley created over several glacial periods during the last ice age. The depth of the valley and the roughness of the scoured flanks of Ben A'an and Ben Venue provide a powerful demonstration of the power of moving ice. Along Strath Gartney, the glacier cut through the ridges which

originally ran down to the pre-glacial valley, leaving a series of sawn-off spurs and hanging valleys where side glaciers entered the main Strath Gartney glacier. These valleys are now occupied by the Strone and Allt a Choin burns, enclosed by the truncated spurs of Meall Dearg and Meall na Boineide. The low pass of Belach a' Choin (350m) represents a minor glacial breach between Strath Gartney and Balquhiddie Glen to the north, with a classic U-shaped profile and small lochan situated near the col.

The broad U-shaped valley occupied by Loch Arklet represents an older stage in the geological history of the area. At this time, the headwaters of the River Forth system flowed westwards from Beinn Ime in the Arrocher Alps, through the Arklet valley into Strath Gartney. During the last ice-age, ice flowing down from the caps to the north of Loch Lomond scoured out the trench of the Lomond valley and severed the upper Forth drainage system at Inveruglas and Inversnaid. The original valley system can still be envisaged when standing at viewpoints on the top of Ben Ime and at the east of Loch Arklet.

2.7.2 Rock Slip Failure (RSF) Complexes

Within the catchment are several sites providing evidence of post glacial processes, in the form a complex of major 'rock slope failures' (see Appendix 3, Loch Katrine: Areas of Geomorphological and Landscape Interest). Within the Loch Katrine catchment there are several sites of interest, including a 0.5km² site above Glengyle House, the side of An Garadh above the Allt a Choin valley and several RFSs on the east side of Cruinn Bhienn, above Strone; whilst to the south of Loch Katrine, RFSs occur along the rim of Maol Mor above the Dhu and on the slopes of Garradh, above Stronachlachar.

The RFSs are characterised by large fissures, as much as 15m deep and 35m wide on Cruinn Bhienn; ridges affected by large bite-shaped features; downslope displacement of large masses of material, including in some cases huge megablocks (one below An Garadh is 20m high by 10m wide by 50m long); and localised rockslide scars and blocky debris piles.

2.7.3 Topography

There is a marked distinction between the landscape east and west of a line through Caistel Corrach and Brenachoile, partly reflecting the underlying geology. To the east the landform is complex, with slopes interrupted by knolls, hummocks and extensive areas of exposed rock faces. Bare mountain tops are craggy in outline and the loch shoreline is irregular with a mixture of inlets and flat rocky promontories. Further west, the topography is less complicated. Above Letter and Edra slopes are longer and smoother, leading less steeply up to rounded rocky skylines. The wide valleys of the tributary burns are a significant feature, as are the truncated spurs which rear dramatically above the lochside.

The relatively broad valley of the Glen Gyle Water widens to form an area of flat

land at the head of Loch Katrine. To the south-east of this, the topography below the ridges of Beinn a Choin and Maol Mor consists of a confused mix of morainic knolls, hummocks and rocky outcrops on the lower slopes which rise steeply to rocky ridges. The hummocky lower ground extends around the flanks of Garadh into Glen Arklet. This is a broad, relatively featurless valley, with small, but deeply cut watercourses. The Corriarklet burn drops steeply from a wide hanging valley which bisects the northern slopes. An extensive area of low undulating hummocky ground at the eastern end of the loch, gives way to the more uneven, knolly southern slopes of Loch Katrine, with small deeply cut water courses. To the east, the amount of exposed rock increases towards the massive rocky slopes and top of Ben Venue, where the typical Trossachs landform reappears.

2.8 Water Quality and Hydrology

The general impermeability of the underlying rocks is responsible for the importance of the area as a water catchment and the high quality of the water. Most rainfall reaches the lochs relatively quickly, due to the 'flashy' nature of the upland catchment. The presence of woodland cover can have impacts on both water quality and yield. As the proposed expansion of broadleaved woodland could affect the hydrological yield of the catchment, two reports were commissioned by SW in 2005. The first was to establish the baseline hydrological yield of the catchment and the second to look at the potential impacts on water yield of increased woodland cover over the catchment (See Appendices 4 and 5). With respect to water quality, an updated report is in preparation and information below is based on information provided in the ICMP (2001).

2.8.1 Water quality

Water from the Loch Katrine catchment is of high quality, with a low pH and low nutrient content (as measured by phosphates and nitrates, among other indicators). This means, however, that water quality is sensitive to both acidification and to nutrient enrichment. During the period when sheep grazing was practiced, the microbial load of the water was generally very low, but with occasional peaks monitored, associated with the lambing cycle.

In terms of land management impacts on water quality, both forestry and agricultural activity are capable of causing direct pollution from the use of chemicals, nutrient enrichment through effluent or fertilisers entering the water supply and microbial contamination, should the prevalence of bacteria and other organisms exceed specified limits. The decision to remove conifers from the catchment has reduced effective risks of acidification through concentration of airborne pollutants by these trees. It is anticipated that, with the construction and added protection of a new filtration system at Milngavie, grazing could be re-introduced in the catchment.

2.8.2 Hydrological Yield

Four methods of yield assessment were used in the baseline report, including two modelling approaches and use of direct and indirect data. The estimated hydrological yields for the two catchments (using all methods weighted according to predicted uncertainties and based on data from 1961-1990) are 1819 +/-185mm for Loch Katrine and 1963 +/- 185mm for Loch Arklet (1961-1990 data), with inter-annual variations of 292 and 317mm respectively. The modelling approaches suggested that estimated yields during the last decade for which data is available (1986-1997) were higher than the long term average and suggested that this might be an indication potential climate change effects. The report highlighted the high level of variability in the estimated yield, both in terms of the uncertainty of the estimate and the inter-annual variation, and that any changes due to land cover change would need to be very large, before an impact would register.

2.8.3 Land Use Change Impacts on Water Yield

The Land Use Change- Impacts to Yield report, considered the impact of increasing woodland cover from an estimated 5% base level, to levels of 40%, 53% and 66% woodland cover (this being actual woodland, with associated open space being included in the balance of the area). This study used the Hydrological Land use Change model, adapted to the UK upland situation. The model assessed the impact of species with relatively dense canopies (beech and oak) and lighter canopies (ash – considered to be possibly more similar to the birch-dominated cover likely to develop). As well as different scenarios and species being modelled, sensitivity of results was tested by varying assumptions relating to the period for which foliage would be present and also by comparing the impact on water yield during summer and winter seasons, 70% of rainfall occurring during the winter months of October to March. The model predicted that for a woodland comprising a mixture of the three modelled species and replacing existing land cover in proportions relative to their existing extent, average annual changes in yield would be as shown below in Table 1.

Table 1: Estimated change in annual yield and precipitation equivalent due to increasing woodland cover over the Loch Katrine catchment to 66%

	% Change in yield	Precipitation equivalent mm	Range (sensitivity)
Average annual change in yield %	-3%	-57	-6%--+2%
Average winter change in yield %	+1%	+40	0--+3%
Average summer change in yield %	-12%	-70	-21%-0

These figures are assumed to provide a conservative assessment of any likely

negative impacts, as due to several of the assumptions made in the modelling process, figures are likely to provide an overestimate of yield reduction due to increasing woodland cover.

The report notes that the change in precipitation equivalent is considerably smaller than either the estimated standard deviation of the predicted yields for the catchment or the inter-annual variation in yield. It concluded that it is considered unlikely that increasing woodland cover by 7,500ha (including open space) is likely to have a measurable impact on water yield under present monitoring conditions.

2.9 Non-woodland Habitats and Plant Communities

2.9.1 Extent of survey information

The table below provides an indication of the approximate coverage of various vegetation types (based on NVC data) within the catchment up to the 350m contour (Potential Woodland Expansion area) and including some areas of higher ground as described below.

Table 2: Approximate extent of various vegetation types in the catchment

Vegetation type	Ha
Rock/montane vegetation	12
Existing broadleaved woodland	605
Existing conifer woodland	122
Upland heath	510
Fen	476
Blanket Bog and mires	3813
Bracken	833
Other	39
Unsurveyed (includes heath, rock and montane vegetation, grassland and blanket bog)	2163
Total	9597

A National Vegetation Classification (NVC) survey was commissioned and carried out in May 2006 (see Appendix 6). This verified 1997 data covering WGS areas at Primrose Hill, Schoolhouse, Coilachra, Boathouse, GlenGyle, Stronachlachar and Glasahoile; and supplements a 2001 survey covering potential woodland expansion areas on the south shore of Loch Katrine. Together these surveys now cover all land within the potential woodland expansion limit below 350m, including land around Loch Arklet. In addition selected areas of higher open ground have been surveyed, including land up to around 700m above the Letter and Strone valleys, the upper slopes and ridges of Beinn a' Choin, Maol Mór and Garradh, the western slopes of Ben A'an and land to the north of this hill. No species of particular note were identified, although the scale and assemblage of habitats is important, since many are included on Annex 1 of the EU Habitats Directive 1992 and are considered

priority habitats for the UK Biodiversity Action Plan (UKBAP). Many of the habitats were found to have been impoverished by grazing.

2.9.2 Habitats and communities (non-woodland)

The lower ground of the catchment is characterised by a complex mixture of dry and wet heaths, mires, woodlands, bracken and grassland, which has replaced dry heaths over extensive areas due to grazing pressure. Woodland occupies the steeper, better drained slopes and steeper burn valleys and occur in an open structure over less steep slopes where soils are wetter and more peaty. Wet heath predominates on moderate slopes, giving way locally to *Molinia* grassland and interspersed by numerous acid rush dominated flushes. Where slopes become more gradual, blanket bog and deep peats occur. Locally, beside the loch shores are small, generally abandoned pasture fields, supporting poor fen vegetation, with rushes and rank grasses in places. Stands of willow, bracken and gorse also occur. Upper slopes tend to be more uniform and support more extensive areas of wet heath, grading to blanket bog on more level areas. On high ground, between 500-600m there is a gradual transition to sub-montane communities. Above about 600m, montane communities of mire and wet heath occur, with grass heath communities in areas affected by snow pack and moss-heath on the windswept summits. Throughout the catchment, base rich communities are extremely limited in extent.

Distribution of these communities is dictated by climate, slope soils and drainage, modified by long periods of heavy grazing, burning and some local drainage. As a result many of the communities have been affected by the loss of the dwarf shrub component.

Dry heaths tend to be restricted to very steep hill slopes and burn ravines through a combination of soils and grazing. Where dwarf shrubs have been eradicated, ***U4 Festuca ovina-Agrostis capillaris-Galium saxatile grassland*** has generally replaced heathland, with limited areas of grassy heath sub-communities occurring where some shrub element still remains. ***H10 Calluna vulgaris-Erica tetralix heath*** is the most widespread community of low ground under 500m, and is characteristic of acid to neutral and generally free-draining mineral soils. Locally on similar soils on north and north-east facing slopes as well as at higher elevations, ***H12 Calluna vulgaris- Vaccinium myrtillus heath*** occurs; whilst ***H21 Calluna vulgaris-Vaccinium myrtillis- Sphagnum capifolia heath*** occurs locally on damp, cool precipitous slopes, sheltered ledges and ravine sides.

Dry heath communities give way to wet heath where gentler slopes occur, on less steep foot slopes receiving drainage or uphill onto plateaux areas, where soils are moist acidic and oligotrophic peats and peaty mineral soils. ***M15 Trichophorum-Erica tetralix wet heath*** is the main community found, often occurring in an intimate mosaic with ***M17 Trichophorum-Eriophorum blanket mire*** on undulating or flat ground or areas affected by discontinuous drift deposits. *Trichophorum-Eriophorum* mire occurs on areas of locally thicker peat development, or as more

extensive areas on upland plateaux, shoulders of hills and valley bottoms. On the deepest and wettest peats, in basins and hollows within stands of M17 mire, *Erica tetralix-Sphagnum papillosum* M18 mire is found. Small areas of *Nardus stricta-Galium saxatile* U5 and *Juncus –Festuca* U6 grassland occur on intermediate soils and margins within the mosaic of wet heath and mire.

Other communities follow local drainage lines within the heaths and mires. Seepage through peat and peaty gleys is marked by M6 *Carex –Sphagnum* mire and locally M4 *Carex-rostrata –Sphagnum* mire within the wettest peats, stagnant hollows and shallow depressions. The M6 mires link with M25 *Molinia caerulea-Potentilla erecta* mire, which marks tracks and channels of well aerated down-slope seepage from bog and wet heath through drier heaths and grassland. *Molinia –Potentilla* mire has expanded into neighbouring areas of wet heath and fringes of blanket bog, where grazing and burning have led to the loss of dwarf shrubs and *Sphagnum* and also where artificial drainage has been undertaken. Across broad less steep slopes around the Letter and Strone Burns, this has resulted in extensive mosaics of *Molinia Potentilla* mire, *Trichophorum-Erica* wet heath and *Trichophorum-Eriophorum* blanket bog.

M23 *Juncus effusus-Galium saxatile* rush pasture which also occurs along burn margins and open slopes marks seepage through less base poor minerals soils and through pasture improved by stock. It is more extensive around the loch margins.

Bracken is prominent across the lower slopes and the U20 *Pteridium aquilinum-Galium saxatile* community is particularly extensive at the boundaries of enclosed land and open hill, on intermediate slopes and around woodland, where it has probably replaced some areas that were previously wooded. With the removal of grazing pressure it is expanding freely into grassland and dry heath stands, and also into the fringes of peaty soils supporting *Nardus-Galium* grassland, wet heath and blanket bog.

Above 600m, *Calluna vulgaris-Eriophorum vaginatum* M17 blanket mire replaces *Trichophorum-Eriophorum* blanket bog and is associated with *Trichophorum-Erica* wet heath along its lower margins. With increasing altitude *Juncus Festuca* grassland replaces wet heath on shallowing peats and *Nardus-Galium* grassland on steeper slopes. Whilst this grassland type occurs extensively over moist peaty base-poor mineral soils on the higher slopes, it is secondary vegetation, having replaced *Calluna-Vaccinium* H12 heath on lower ground and *Vaccinium-Descampsia* heath H18 higher up. There are also small localised patches of *Festuca ovina-Agrostis capilaris-Galium saxatile* grassland, U4. On the steep slopes of the low-alpine zone, the *Nardus* sward gives way to *Nardus-Carex* grass heath, particularly in gullies, hollows and corries where snow melt is slow, whilst this in turn gives way to *Carex bigelowii- Racomitrium lanuginosum* moss-heath, U10, on windswept summits and ridges.

Crags throughout the catchment are generally accessible to grazing and vegetation tends to consist of *Nardus-Galium* grassland or dry heath. Where grazing has been very light or absent, such as on the north and north-east facing slopes of Maol Mor

and Beinn a Choin, the *U16 Luzula-Vaccinium tall-herb community* occurs. Species poor, but more extensive areas of this vegetation type are found on lightly grazed slopes, with species rich stands limited to much smaller inaccessible crags, where they are often mildly flushed. On lower slopes *W17 Quercus-Betula-Dicranum woodland* often occupies ungrazed crags. The base-rich equivalent of U16, *U17 Luzula-Geum* community and associated *U15 Saxifraga-Alchemilla* bank community occur only below crags and on faces irrigated with base rich waters. Base rich flushes and grassland are similarly limited in extent and occur only on talus slopes below Mael Mor and above Strone Burn, where crumbling rocks release base-rich minerals, which are then concentrated by water. *Carex-pinguicula* mire follows seepage tracks and grades into *Carex-saxifraga* mire on richer soils with more diffuse water flows, with *Festuca ovina-Agrostis capillaris-Thymus polytrichus CG10 grassland* on drier margins.

In terms of relationship to woodlands, some habitats such as bracken stands (U20) are likely to have once supported woodland, whilst a number of these habitats are likely to revert to woodland, with a sufficient seed source and reduction in grazing.. The most suitable places for woodland regeneration also tend to be the least valuable habitats. These include the *Pteridium-Galium* community, *Festuca-Agrostis-Galium* and *Nardus-Galium* grasslands, which are likely to revert to oak woodland; *Molinia-Potentilla* mire, *Juncus-Galium* rush-pasture – which would succeed to wet birch woodland, where vegetation is not too rank; species-poor swards of *Luzula-Vaccinium* tall-herb community (W17 oak woodland) and conifer plantations. The *Pteridium-Galium* community in particular is both extensive and closely juxtaposed to existing woods, and provides ideal conditions for native woodland expansion by natural regeneration.

2.9.3 Bryophytes and Fungi

A range of bryophytes have been listed for the catchment, but no species of particular note have been identified, other than *Mycena rubromarginata* (Red Edge Bonnet) on Douglas Fir litter. Although included on the provisional bryophyte red list, this species is proving more widespread than previously thought.. Veteran sycamores in the shoreline area of Brenachoile SSSI are noted as supporting *Lobaria* lichens.

A limited Fungal Survey of a sample of selected habitats was undertaken in 2005. This identified one species of note, *Sistroma oblongisporum*, on veteran oak within Brenachoile SSSI, which has only been recorded at two other sites in Scotland, and a further species, *Cortinarius velonovskii*, in Scots Pine near the Letter Burn, not previously recorded in the country. Otherwise common assemblages of mycorrhizal fungi were found within oak woodlands, but some unimproved rather rank grassland areas were found to have an impoverished fungal community, although reasons for this were not clear. Finer swards on drier knolls were found to support *Hygrocybe reidii* (Honey Waxcap), although other waxcap species were not identified at the time.

2.10 Existing trees and woodlands

2.10.1 Woodland Types and distribution

There is a total of 891ha of existing broadleaved woodland within the catchment lease area. In addition, there is 210ha of developing woodland (areas of regeneration and new planting that are not yet established) mainly within the Primrose Hill, Schoolhouse Wood and Stronchlachar WGS areas. Remaining conifer plantation in the lease area covers some 122 ha of land. 604ha of the broadleaved area (including Ben A'an and Brenachoile SSSI) is classed as ancient semi natural woodland (ASNW); and 65ha of the remaining conifer plantations within the Primrose Hill and Schoolhouse wood areas occupy sites which are classed as Planted Ancient Woodlands (PAWs).

Most of the broadleaved woodland is concentrated around the shores and lower slopes of Loch Katrine. Larger and more continuous areas of woodlands are concentrated at the eastern end of the catchment, towards the western end and in Glengyle remnant woodland areas tend to be more fragmented and isolated. Along the northern shore of Loch Katrine, woodland boundaries are straighter, reflecting old landuse patterns and stands tend to be dominated by a closed oak canopy; whereas along the southern shore and at the eastern end of Loch Arklet woodlands are frequently more birch-dominated and open in character, with very variable canopy cover. These birch woodland areas are discontinuous, with interlocking shapes following more natural boundaries which extend up gully lines to peter out at around 250-300m on the upper slopes.

Woodland development within the catchment shows a close association with underlying soils, with most existing woodland found in areas with a higher proportion of peaty podzols, humus iron podzols, peaty and non calcareous gleys and brown forest soils. These occur more widely along the shoreline and over the lower slopes around Loch Katrine, as well as on the valley slopes above Glen Gyle, around Strone and Schoolhouse and on Primrose Hill. Extensive areas of soil mosaics dominated by poorly drained peats and peaty gleys in association with peaty podzols and peaty rankers are found on the colder slopes on the southern side of the Loch Katrine and Loch Arklet and on high level land around Cruinn Bheinn on the northern shore of Loch Katrine. Much of the land occupied by such soil mosaics remains either unwooded or colonised by very open woodland.

The main broadleaved woodland areas around the lochs have been surveyed to NVC level in surveys of 1997 and 2001; Ben A'an and Brenachoile SSSI's had been surveyed previously when assessed for SSSI status. (see Appendix 6, NVC Survey and Appendix 7, SSSI Management Plan).

Existing broad-leaved woodlands are divided into four broad types, all of which are included as priority habitats under the EU habitats directive and the UKBAP.

a. Wet birch woodland; *Betula pubescens*- *Molinia caerulea* (W4)

These birch woods develop on moist, moderately acid peaty and peaty-gley soils, with a marshy or peatland ground flora. Within the catchment the W4b, *Juncus effusus* sub-community, on wet flushes and mires and the W4c *Sphagnum* sub-community are present. Downy birch *Betula pubescens* is the most common and usually dominant species, but in the open canopied stands associated with Glen Gyle, alder forms a substantial component, with a ground flora of *Juncus acutiflorus* and tufted hair grass, *Deschampsia flexuosa*. Willow species are also associated with this woodland.

Wet birch woodland often occurs in small localised stands on wetter soils within larger woodland areas as in Brenachoile and Ben A'an woods. Within the Loch Katrine catchment, wet birch woodland is found as small stands close to the loch margins below Edra, within the Schoolhouse wood area, near to the Shore road to the north and south of Stronachlachar, as well as south of the loch. The most extensive areas occur along the valley of the Glen Gyle Water, where over-mature birch and alder form the main components. Elsewhere regeneration of eared willow *Salix aurita* and grey willow *S. cinerea* is slowly expanding this woodland type onto wet heath.

b. Upland oakwoods; *Quercus petraea* – *Betula pubescens* – *Oxalis acetosella* woodland (W11)

Upland oakwoods are found on moist, free draining but quite base-poor soils. Within the catchment, three sub-communities are present : W11a *Dryopteris dilatata*, (bryophyte rich oceanic type), W11b *Dicranum majus*) and W11c *Anemone nemorosa* (more continental type, but also indicative of grazing pressure). The dominant species are oak (including both sessile oak *Q. petraea* and pedunculate oak *Q. robur*) and birch (silver birch *B. pendula* and downy birch *B. pubescens*) and these occur both as mixtures and as almost pure stands of oak or birch. Minor associated species such as rowan are relatively scarce. The ground flora has been very much modified by grazing and is dominated by grasses, except where vigorous stands of bracken *Pteridium aquilinum* occur. Birch and rowan regeneration are common, but generally there is very little oak regeneration present and where this occurs, seedlings are unable to develop due to the often dense canopy overhead.

This woodland type is extensive within the catchment and includes the Brenachoile SSSI area and woods to the west of this, woodlands around the Letter burn, Portnellan, Boathouse and within the western end of the Schoolhouse WGS area, woodlands around the Allt a Choin burn and in the Glasahoile area. Within some woods, such as Brenachoile and Ben A'an, a significant area is affected by the invasion of non-native rhododendron, *Rhododendron ponticum*.

c. Upland Birchwoods; *Quercus petraea* – *Betula pubescens*- *Dicranum majus* woodland (W17)

This woodland community is characteristic of steep rocky hillsides on shallow free draining acid mineral soils, especially where there is accumulation of humus or soils are strongly leached (humic iron, podzols and peaty podzols). Birch tends to dominate, with sessile oak only occurring on drier soils at lower altitudes. Locally, associated tree and shrub species such as rowan, *Sorbus aucuparia*, holly, *Ilex aquifolium*, and hazel, *Corylus avellana* are found, but aspen *Populus tremulus*, and juniper, *Juniperus communis* are limited to the Ben A'an SSSI. The absence of a shrub layer is a result of past heavy grazing, but in some less heavily grazed areas dwarf shrubs, such as Ling, *Calluna vulgaris* and bell heather *Erica cinerea* do occur and increase the structural diversity of the stands. The main sub-community is W17b *Isoetes myosuroides*- *Diplophyllum albicans*, found along the Strone burn, at the eastern end of the Schoolhouse area, on the eastern slopes below Beinn A Choin and Maol Mor ridge, to the south of Loch Arklet and along the lochside in the Silver Strand area. The W17c *Anthoxanthum odoratum*- *Agrostis capillaris* type is found to a lesser extent at the eastern end of the Schoolhouse WGS area, within Strone Woods and below Garadh near Stronachlachar. W17 woods are also found along the southern slopes of Glen Gyle, at Coilachra, above Glasahoile and Culligart, and also represents the dominant woodland type within the Ben A'an SSSI, where oak dominates on drier ground and birch on wetter areas, over an understory of blaeberry *Vaccinium myrtillus* and ling, *Calluna vulgaris* with occasional holly, ash, juniper and aspen. Where local enrichment has produced ash woodland over Dogs Mercury, *Mercurialis perennis*, the locally rare Wood Sedge *Carex sylvatica* occurs. As for W11 woodland, invasion by non-native rhododendron is also a problem within some woods and Ben A'an wood in particular.

d. *Alnus glutinosa* - *Fraxinus excelsior* – *Lysimachia nemorum* (W7)

Upland Mixed Ashwoods are associated with flushed soils on steep well drained slopes, which are moderately basic or only mildly acidic. Where this woodland type occurs, it is dominated by ash *Fraxinus excelsior*, downy birch, *Betula pubescens*, with occasional rowan and hazel and ground flora shows a strong calcicolous element. This woodland type occurs very locally within the Ben A'an and Brenachoile SSSI and on talus slopes below Maol Mor, with small areas north and west of Glengyle House.

e. Young native woodland plantations and natural regeneration areas

There are currently 210ha of establishing woodland, located at Stronachlachar, Schoolhouse and Primrose Hill.

f. Conifer Woodland

Extensive areas of conifers have been felled over the past decade on the upper slopes of Primrose Hill and in the Schoolhouse area. Remaining conifers are concentrated at four main locations. These include to the north of Ben A'an SSSI, and at Primrose Hill, Schoolhouse woods, Boathouse wood and a small area on a headland north of Stronchlachar.

The PAWS site on Primrose Hill was partially windblown in 1968 and has since recolonised with naturally regenerated Sitka spruce. It now consists of clumps and scattered spruce with some rhododendron, interspersed with open areas of heavily browsed birch and eared willow regeneration. Open ground mosaics are used by abundant butterflies, including Small Pearl Bordered Fritillaries. More extensive stands of spruce at this location have virtually no remaining ground flora, except for some common mosses, oxalis and hard fern at margins, but provide shelter to adjacent open ground habitats and regenerating broadleaves.

The PAWS area north of Ben A'an consists of mature Norway spruce, *Picea abies* Larch *Larix sp* and Sitka spruce, *Picea sitchensis*, and is developing a varied structure where regeneration of birch and conifers has occurred in patches of old windblow. Ferns characteristic of western oakwoods are present and the ground flora more interesting. Mature stands of Douglas Fir, *Pseudotsuga menziesii* occur along the shore road. The Boathouse PAWS area consists of dense unthinned Sitka Spruce with some Douglas Fir, with much rhododendron throughout. The road bisects this woodland, which shows signs of instability. The Schoolhouse area consists of an extensive block of Sitka spruce (non PAWS), as well as patchy areas of self-sown semi-mature Sitka spruce above and below the road.

Excluded from the lease area are policy plantings associated with the car park at the Trossachs Pier and residences at Brenachoile, Letter, Glengyle and Stronachlachar. These areas are generally mixed woodland and are significant, not only in landscape terms, but because they represent significant seed sources of non-native species, and particularly of rhododendron. The only significant area of policy woodland within the lease lies to the west of Glengyle House.

2.10.2 Past Management and Regeneration Potential

Many woodland areas show signs of past management. Early management for animal shelter and fodder is demonstrated by areas of ancient wood pasture at Glen Gyle, with veteran alder, birch and hazel and to the north-east of Loch Arklet (below Garadh), again with a mix of species. Old ash and oak pollards are also present on crags within Ben A'an wood and alder pollards on the Am Priosan headland.

By the 1700's, a coppice with standards system had become common, to provide bark for the tanning industry as well as fuelwood from birch charcoal. Some stands were subsequently selectively thinned to provide chockwood for the tunnels associated with water supply system. These practices have left relatively even-aged

areas of oak-dominated closed canopy woods, with well spaced trees along the northern shore and at Glasahoile. Within Brenachoile SSSI, for example, there are virtually no remaining old birch trees.

Extensive grazing has also had a major impact, with most woodlands having very impoverished shrub and ground flora layers, often dominated by grasses. Regeneration has been long absent in some areas, and apart from an apparent flush of regeneration some 30-40 years ago, with several dense stands of birch originating from this time, there is little evidence of younger trees. Woodland surveys in 1997 showed evidence of regeneration in many areas, but poor recruitment due to grazing pressure. Along Glen Gyle, however, remnant woodlands of birch and alder are over-mature, whilst under closed oak canopy in Ben A'an SSSI, oak regeneration is very poor, probably due to a combination of shade and defoliation by insects. Within Ben A'an Woods, however, good evidence of regeneration of birch and rowan has been noted for the 2003-2005 seasons, with little evidence of browsing.

Regeneration plots instituted in 2003 after the removal of sheep from the catchment, have demonstrated that good densities of regeneration of downy birch and to a small extent of willow and rowan have occurred on the southern slopes of Loch Katrine and Loch Arklet. Counts undertaken in 2003 and 2005 and 2007 also showed that at current grazing levels and despite apparent deer densities of 5/km² in South Katrine, seedlings have been able to develop and move up size classes in the intervening period. North Katrine show much lower densities of regeneration.

2.11 Birds

Survey information is available from a 2006 Moorland Bird Survey, Surveys of Ben A'an and Brenachoile SSSI and a survey undertaken within areas affected by the 1997 ES and information obtained for the ICMP. The earlier information is less extensive than the 2006 survey and only identifies 5 species in addition to those founding the 2006 Survey. These are the **Pied Flycatcher**, *Ficedula hypoleuca*; the **Wood Warbler**, *Phylloscopus sibilatrix*; and the **Tawny Owl**, *Strix aluco*; all species associated with woodland, and **Graylag Geese**, *Anser anser*, and **Red Breasted Merganser**, *Mergus serrator*, associated with the lochs.

According to the previous survey information, within Ben A'an SSSI there are good breeding populations of Pied Flycatcher, Wood warbler, Tree pipit, *Anthus trivialis*, and **Redstart**, *Phoenicurus phoenicurus*, as well as **Blue Tits**, *Parus caeruleus*, **Great Tits**, *Parus major* and Tawny owls. Greylag Geese and Red-breasted Mergansers breed around the upper end of the loch, probably using inlets to the north of Stronachlachar. The last recorded sighting of **Capercaillie**, *Tetrao urogallus* within the catchment was 1998, with Loch Lomond being the nearest core area for this species.

A Moorland Bird Survey was undertaken in 2006, covering land within the potential regeneration limit as defined by the 350m contour line, but excluding the larger broadleaved woodlands and conifer blocks. It is included as Appendix 8. Within the UK, British Trust for Ornithology (BTO) lists of priority species are commonly used to denote bird species considered under threat. The survey recorded 62 species, including 10 red list species (those under most threat globally) and 25 amber list species (of unfavourable conservation status locally and within European). The list also included 9 raptor species.

Eight species present are listed under Annex 1 EC Directive 79/409 on the Conservation of Wild Birds: **Hen Harrier**, *Circus cyaneus*; **Golden Eagle**, *Aquila chrysaetos*; **Merlin**, *Falco columbarius*; **Peregrine**, *Falco peregrinus*; **Red grouse**, *Lagopus lagopus*; **Black grouse**, *Tetrao tetrix*; Short-eared owl, *Asio flammeus*, and **Raven**, *Corvus corax*. Most are dependent on moorland and upland areas for either breeding or feeding.

Red list species (those of greatest conservation concern) include two species associated with open moorland and heathland (Hen Harrier and **Skylark**, *Alauda arvensis*) and a further 8 species associated with open woodland, scrub or wood/moor mosaics, including **Bullfinch**, *Pyrrhula pyrrhula*; Black Grouse; **Grasshopper Warbler**, *Locustella naevia*; **Linnet**, *Carduelis cannabina*; **Reed Bunting**, *Emberiza schoeniclus*; **Spotted Flycatcher**, *Muscicapa striata*; **Starling**, *Sturnus vulgaris* and **Song Thrush**, *Turdus philomelos*.

Amber list species (BTO list of species of conservation concern) include 7 species associated with open moorland – **Curlew**, *Numenius arquata*, Merlin, **Meadow Pipit**, *Anthus pratensis*, Red Grouse, **Stonechat**, *Saxicola torquata*, Short-eared Owl and **Snipe**, *Gallinago gallinago*; 3 species associated with cliffs or crags and surrounding open ground habitats– Golden Eagle, Peregrine and **House Martin**, *Delichon urbica*; 3 species dependant on the lochs; - **Common Gull**, *Larus canus*, **Osprey**, *Pandion haliaetus* and **Gray Wagtail**, *Motacilla cinerea* and 9 species associated with woodland habitats including woods, (**Woodcock**, *Scolopax rusticola*), open woods (**Willow Warbler**, *Phylloscopus trochilus*, Tree Pipit, Redstart, **Lesser Redpoll**, *Carduelis cabaret*, and **Dunnock**, *Prunella modularis*), woods with moorland (**Kestrel**, *Falco tinnunculus*), woods with conifers (**Goldcrest**, *Regulus regulus*) and woods near grassland (**Mistle Thrush**, *Turdus viscivorus*). A further 2 species are associated with grassland near building or non-specific habitats (**Swallow**, *Hirundo rustica*, and **Cuckoo**, *Cuculus canorus*).

Table 3: Breakdown of habitat distribution of upland nesting birds (Adapted from Fuller 1982)

Habitat	Red Data Book species associated	Amber Data Book species associated	Other species associated
Buildings		House Martin, Swallow	
Lochside or river	Osprey		Canada Goose, Common Sandpiper, Dipper, Grey Wagtail, Pied Wagtail
Woodland, scrub, trees (* = wood and moor mosaic)	Black Grouse*, Bullfinch, Grasshopper Warbler, Linnet*, Osprey, Song Thrush, Sparrowhawk, Spotted Flycatcher, Starling, Reed Bunting (s)	Cuckoo, Goldcrest, Kestrel, Lesser Redpoll, Mistle Thrush, Redstart, Tree Pipit, Willow Warbler, Woodcock	Blackbird, Blue Tit, Chaffinch, Chiffchaff, Coal Tit, Dunnock, Great Spotted Woodpecker, Great Tit, Grey Heron, Jay, Robin, Rook, Siskin, Treecreeper, Whitethroat, Woodpigeon, Wren
Blanket bog	Merlin, Hen Harrier, Skylark	Common Gull, Cuckoo, Meadow Pipit, Red Grouse, Short-eared Owl	Mallard, Snipe,
Well drained, gently sloping heather or grass moorland	Hen Harrier, Merlin, Skylark, Reed Bunting,	Common Gull, Cuckoo, Curlew, Meadow Pipit, Red Grouse, Short-eared Owl, Snipe	Carrion Crow, Hooded Crow, Stonechat, Wheatear, Whinchat, Wren
Steep sloping heather or grass moorland	Buzzard		Carrion Crow, Hooded Crow
Crags, rocky outcrops and scree	Skylark, Starling,	Golden Eagle, Meadow Pipit, Peregrine, Red Grouse, Kestrel House Martin (s), Mistle Thrush (s)	Pied Wagtail, Raven, Wren, Wheatear, Blackbird (s), Gray Heron (s)
Montane Heaths/grass	Skylark	Meadow Pipit, Red Grouse	Wheatear

Bird distribution was found to be greatest in areas with the greatest structural diversity, including mosaics of woodlands, crags, wet heath and grassland and bracken. Most species present are dependent on a range of habitats and over half of the species (34) require woodland, scrub or trees as their primary habitat. Seven of the 62 species are considered to be dependant on solely open habitats and include Meadow Pipit, Skylark, Red Grouse, Curlew and Snipe, Hen Harrier and Short-eared Owl and Golden Eagle. Some species such as Hen Harrier and Short-eared Owl, predominantly associated with open ground will use forest edge and young woodlands before canopy closure for hunting. Recent research into Golden Eagles, indicates a preference for open country, with old, widely spaces trees, linked to large open areas. Dense tree cover however, reduces the availability of prey species.

The two species of greatest local interest in terms of potential woodland impact are Golden eagle (due to rarity as there are only 300 breeding pairs in the country and Black Grouse (due to concern over their current decline). There are 2 pairs of Golden Eagles in the catchment and at present four established Black Grouse lek sites, with a further 2 leks within Loch Ard Forest, less than 1.5km from the southern boundary, and one on adjacent RSPB land at Garrison. In addition to these are a number of recent ephemeral lek sites, used by single birds. The established leks are sited at Culligart, Coille Mhor and south-east of Loch Arklet on the southern side of Loch Katrine, with one lek near Letter (between proposed planting areas 34 and 35) on the north side. Counts over the period 2003-2006 have shown the Culligart and Loch Arklet leks to have the greatest number of displaying birds, with between 6-9 and 6-10 birds respectively. Letter has been used consistently since 2003, but by only one or two birds, although in 2002, 5-6 displaying males were recorded at this location. The total number of lekking birds sighted each year has varied from 14 to 19 between 2003 and 2007.

2.12 Other Fauna

There have only been no systematic surveys of animals present in the catchment, but a number of species have been recorded as being present. Some information was also provided through the ICMP consultation process.

2.12.1 Mammals and Reptiles

Red and roe deer are both present and occasional **Sika deer** have been found in the locality. Roe deer numbers are difficult to estimate, but roe are assumed to be distributed across the catchment at very low numbers. Red deer are present on open hill and woodland edges. Open range counts have been undertaken annually since 2000, using helicopters, and show a substantial increase in deer numbers from 318 to 827 in the North Katrine area between 2002 and 2007, following the removal of

sheep in 2002. This has been as a result of immigration and increased fecundity, and cull levels have been increased to reflect some of this change. In the smaller South Katrine area, covering Ben Venue and South Loch Arklet, overall populations have been maintained at between 134 and 344 animals, due to a strong control policy to protect woodlands to the south. At current population levels, regeneration in trial plots is still developing, despite the relatively high deer density of 13/km² in North Katrine and 5/km² in South Katrine.

Other mammals and reptile species have been reported in the area, but specific information on numbers or location is lacking. Badgers, bats, wild goat, otters, adders and bats are known to be present within the catchment.

Otters have been seen at Glengyle and spraints found along the shore of Loch Katrine in the SSSI area. These are a priority species under the UKBAP.

Badgers have been reported prior to 2002, but there is no information at present on the location of setts. Measures must be taken to avoid disturbance to setts during land management operations.

Red Squirrels are known to be present and to use the conifer and broadleaved woodland to the north-east of Loch Katrine. Red Squirrels are a priority species under the UK and Stirling BAPs.

Gray Squirrel: There has been one recent sighting of grey squirrel, (anecdotal) which were not previously known to be present in the area.

Pine martin are also present in the north of the catchment.

Feral goats: 2 billies were sighted in 2000, prior to this there were no recorded sightings.

Bats: The catchment has been recorded as containing four species of bat: Pipistrelle, Long-eared, Natter and Daubenton's. All are associated primarily with buildings within the catchment, although all require good prey sites that can include wetlands and woodland edges. All are Schedule 5 protected species under the Wildlife and Countryside Act 1981 and amendments, and also under Schedule 2 of the Conservation (Natural Habitats) Regulations, 1994. Pipistrelle Bats are a priority species in the UK and Stirling BAPs.

Mountain Hares would be expected within the catchment, but no sightings have been reported. It is possible that overgrazing has reduced good habitat. They are an important prey species for the many raptor species and are a priority species under the UK and Stirling LBAP

Water vole: have not been specifically recorded within the catchment, although are present according to the Stirling LBAP Species Action Plan for water voles.

Common Lizard, *Lacerta vivipara* has been recorded in the Ben A'an and Brenachoile SSSI.

2.12.2 Invertebrates

Only occasional records of butterflies of interest have been made. In 1988 **Pearl Bordered Fritillary**, *Boloria euphrosyne*; **Common Blue**, *Polyommatus incaris*; and **Green-veined White**, *Pieris napi*, were recorded within Brenachoile SSSI. **The Small Pearl Bordered Fritillary**, *Boloria selene*, was noted as being present

on Primrose Hill, within a PAWS site, in 2006. The Pearl Bordered Fritillary has been in decline and is a priority species in the UKBAP. Current presence or distribution is unknown. An invertebrate survey was undertaken in September of 2005, but was largely unsuccessful due to inclement weather conditions. Only one species of interest was noted – a moth, **The Small Chocolate Tip** *Clostera pigra*, although habitat likely to support another priority moth species, the **Argent and Sable** *Rheumaptera hastata* was identified near Loch Arklet. Little else is known for areas other than the Ben A'an and Brenachoile SSSI, which has been surveyed more intensively and is known to hold beetles and hoverflies of note, as well as several nests of **Small Headed Wood Ants** *Formica aquiline*. This is a priority species under the UKBAP.

2.13 Historical context and land use

Loch Katrine holds an important place in local history and folklore and reflects the history of much of highland Scotland in terms of changes in land use and population. There is little evidence of pre-medieval structures, although the area was probably in use from pre-historic times. From the medieval period, the area would have supported a population of several hundreds, with families living as tenants to their clan chief. Farmsteads and small settlements were scattered around the lower loch shore, with the populace surviving on an economy of cattle grazing and limited crop husbandry, using woodlands for fodder and fuel. During the summer, animals would typically be grazed on the higher slopes, often under the care of women and children, living in temporary shelters or shieling huts.

The MacGregor clan is closely associated with the area. Both of the MacGregor clan graveyards are located near to Loch Katrine, one near the western end of the loch, the other at Portnellan on the north shore was in use between 1611 and 1849. A MacGregor stronghold also existed on Ellen's Isle. Rob Roy MacGregor, famed for cattle raiding and the harassment of drovers, was born at Corriearklet in 1671 and later married there. The area is closely associated with his activities. Places of particular interest in this context include Am Priosan (a headland at the south-east end of the loch and now part of the SSSI), which is mentioned in records from the 1740's as a being considered a place to keep cattle safe from enemies; and Bealach nam Bo (Pass of the Cattle) on the northern slopes of Ben Venue, on the route of a drove road reputedly used by Rob Roy to smuggle cattle from the lowlands back to Glen Gyle.

Both Glen Gyle and Glen Arklet were important strategic meeting places and would have been used as drove routes. As a strategic route connecting the Argyll Glens and the main cattle markets, Strath Gartney probably saw most activity during the early 19th century, after Falkirk superseded Crieff as the main market and before droving began its decline.

The area would have been affected by the general unrest during the Jacobite rebellions, following James VII /II exile to France in 1688. The construction of the

Garrison near Inversnaid in 1713 and the Military Road from Inversnaid, via Glen Gyle to the Dunkeld/Ruthven Military route by 1718 are a reflection of this period. Neither the Garrison or the road were used extensively in the second half of the 18th century and the road was not recorded on later 1863 OS maps. Following the 1745 rebellion, parliament passed a series of laws to break down the clan system and destroy the feudal power of the clan chiefs. At the same time enclosure of land and eviction of the local population in favour of sheep and deer commenced and by the mid 19th century, the area was relatively sparsely populated.

With the arrival of sheep, shielings and farmsteads were abandoned and features such as stone dykes and sheepfolds began to appear in the landscape, often using stone robbed from earlier buildings and structures. The population continued to decline through the 19th and 20th centuries and the local school eventually closed in the 1920's. Nowadays there is a small community resident in the area, occupying various houses and steadings around the Loch and in the village of Stronachlachar, which is still a local base for Scottish Water.

The area became a popular tourist destination from the late 1700's and writers, poets and artists of the Edwardian and Victorian periods visited and popularised Loch Katrine in their work. The paddle steamer, the Sir Walter Scott commenced operation in 1843 and Loch Katrine has continued to attract visitors since this time.

The importance of the area as a source of water for the growing city of Glasgow began in 1859 with the construction of the waterworks, tunnels and aqueduct between Royal Cottage and the Mugdock storage reservoir. The site passed into public ownership during the 1920's and thereafter was managed with water supply as the primary consideration, with agriculture, forestry and tourism as the main subsidiary operations.

Woodlands in the area have been closely affected by the changing cultural history and land management practices. From the time the area was first settled, they would have been an important source of fuel and fodder, as well as providing grazing and shelter for cattle. This form of management can be seen in examples of pollarded alders found within the Ben A'an and Brenachoile SSSI, Glen Gyle and at the western end of Loch Arklet. Records of active management exist from as far back as the 1750's, by which time the oakwoods at Brenachoile were enclosed by a stone dyke and being managed profitably under a coppice with standards system. Worked on a 24 year cycle, the coppice was used for charcoal (possibly to fuel the iron foundry established along the River Achray in 1724), and the oak bark for tanning. Further evidence of management is seen in the presence of pedunculate oak, *Quercus robur*, as opposed to the local sessile oak (*Q. petraea*), in several woodlands, where it would have been introduced by supplementary planting. Following construction of the waterworks, woodlands began to be managed for the production of chockwood and selectively thinned in some cases. Commercial conifer plantations were introduced from the 1920's, at about the time that a sawmill commenced operation within the catchment.

As sheep gradually replaced cattle, many of the woodland areas have been affected by heavy undergrazing, leading to the development of more open, sparse woodland in places where regeneration has been prevented. Some woodland areas have become moribund. With the removal of sheep from the area in 2002, indications are that new regeneration is now beginning to develop.

2.14 Cultural Heritage and Archaeology

To date, a total of 176 features or sites of archaeological interest have been identified by survey within the Loch Katrine and Loch Arklet catchments, of which 166 lie within the lease area. Although none of the sites or features are considered to be of regional or national importance, they are individually and collectively of local significance and providing a rich record of the more recent cultural history of the area.

2.14.1 Historic land Use Assessment (HLUA)

The remains present relate to several aspects of the history of the area. The Historic Landuse Assessment (HLUA) of the area identifies areas along both the north and south shore of Loch Katrine, as well as along the southern side of Glen Gyle and small pockets of land to the south of Loch Arklet, as being associated with the 18th-20th century period. Almost all of these, with the exception of a few small areas of better quality grazing land, coincide with ancient woodland areas, whilst land above Letter and Edra are thought to have been used as grazing land in medieval times.

The assessment of the relict landscape includes relatively few extensive areas. These include an area of lower slope, lying above and between tongues of ancient woodland located between Primrose Hill and the Letter Burn; an area occupying lower slopes between Strone Wood and the Letter burn and an area at Culigart along the southern loch shore. In addition there are a number of smaller relict areas identified, 5 along the southern loch margins, with an outlier above Culigart, 2 in the lower Glen Gyle valley, 2 along the upper Strone Burn and one on a tributary and 1 on the upper Letter Burn.

The whole catchment, up to the 350m potential regeneration limit has now been surveyed for archaeological remains and sites. The surveys suggest that the majority of remains date from the 18th and 19th century, although it is recognised that many of the sites could have had continuous occupation from before this time.

2.14.2 Survey Information

In addition to the industrial heritage associated with the water supply works, farmsteads and graveyards which lie outwith the lease area, two surveys have

identified a total of 176 sites of archeological interest within the area of Potential Woodland Expansion of the catchment as defined by the 350m contour line. Of these, 166 lie within the lease area.

a. 1997 Glasgow University Archaeological Department (GUARD) Survey:

This survey covered areas affected by the 1997 Woodland Grant Scheme and Environmental Statement and included most of the main woodland blocks as well as associated land at Stronachlachar, Glen Gyle, Glasahoile, Primrose Hill, Boathouse and School House where woodland expansion was proposed. These areas generally lay within 1km of the loch shore. This survey identified 84 sites of local interest including a wide variety of features. 8 are located within Ben A'an and Brenachoile SSSI (6 within the lease area). 10 of these sites (nos. 2,12, 36-40,73,78,79,82), including 2 within Ben A'an Woods SSSI, lie outwith the lease area.

Artifacts thought to be associated with post medieval settlement patterns are most common including building remains; enclosures and areas of cultivation or drainage as well as boundary features, such as stone dykes and banks. In addition there are features associated with access and industry: including the military road, other tracks, culverts, bridges or bridge footings and quarries; lime and other drying kilns and bloomeries (slag heaps representative of iron workings). There are also a number of features associated with the waterworks – the aquaduct, dams, shafts and stonework at the end of watercourses. These are listed in Appendix 9 and shown on the Archeology Constraints Map 4a.

c. 2006 Headland survey:

The most recent survey extended the area of survey up to the 350m potential woodland expansion limit. A further 92 sites or collections of features, including 250 individual structures and areas of cultivation were identified. Most of these sites are found on south and south-west facing slopes above the lochs. One additional site was identified within the GUARD survey area. A copy of this report and associated maps is provided in Appendix 10, with a summary shown on Archeology Constraints Map 4b.

The majority of these structures (110) are the footings of buildings. Most are located on shelves on hillsides, or are set just above the valley floors of the smaller glens, close to water. Often located in small groups they represent shieling huts dating from medieval times or later, although one possible pre-historic site was recorded on slopes to the north of Loch Arklet. Much of the original stone from these huts is likely to have been re-used in building of later drystone dykes.

Many of the remaining features tend to be associated with deserted farmsteads, which reflect the removal of crofters and land use changes from the mid 18th century. These structures tend to be located on lower ground above the lochs and include banks, dykes, sheepfolds and other enclosures and cultivation remains. The additional sites identified suggest that post medieval landuse of the area extended further up Glen Gyle and was more extensive along the north shore of Loch Arklet than has been previously recognised.

Two road lines were identified, to the north and east of Loch Arklet. The Military Road from Garrison to Stronachlachar and its associated quarries and culverts dates from 1718, and runs approximately parallel to the modern road. It is relatively well preserved, with twin lines in places suggestive of later attempts to straighten the route. The second roadline runs joins the military road near to the existing road junction and heads to the south-east. It is recorded on the Stobies Map of 1783 and possibly represents the original line of the A829 road.

The final category of features is associated with the waterworks and includes a tower, shafts and a marker obelisk along the line of the conduit near to Royal Cottage.

2.15 Tourism and recreational use of the site

2.15.1 Tourism and tourist facilities

The special qualities of Loch Katrine and accessibility of the area allows a wide range of experiences and provides opportunities for active out door recreation as well as the appreciation of scenery and wildlife and the enjoyment of tranquillity. The dramatic mountain scenery attracts many hillwalkers and the wider local offers long distance footpaths and cycling routes, which could be linked to the site.

Loch Katrine has been an important tourist destination within the Trossachs, since the late 18th century. Visitor number estimates range from 180,000 to 250,000 (last figure from LL&TNP Visitor Survey, 2003) The number of visitors to the area have increased following the establishment of the LL&TNP in 2002 and numbers are predicted to increase further. Loch Katrine represents one of the honey pot locations within the park, with most visitors (whether interested in active or passive recreation), essentially visiting the area for its landscape and natural beauty.

The main tourist facilities provided are boat trips between the Trossachs and Stronachlachar Piers on the Sir Walter Scott and at the Trossachs Pier, café, shop, bike hire and boat hire for trout fishing. These activities are all operated by third parties. There is relatively limited scope to expand activities further around the loch, and car parking is already limited on peak visitor days. However, The Sir Walter Scott Trust is seeking to run a second shuttle boat, which will eventually visit some of the smaller jetties around the loch and have funding in place to upgrade Brenachoile Pier. To support this development, there is scope to provide some additional recreational paths near to the Brenachoile pier that would allow a circular route from here back to the Trossachs car park, as well as to create additional local loops at Schoolhouse and Stronachlachar.

The Loch Katrine area is well used by walkers and cyclists and the shore road is the main available low level route, which also provides all ability access. The Loch Katrine Visitors Research Report 1999, found that visitors were representative of a

range of age groups, with the average duration of visit being 1.5hrs. 84% of the respondents used the shore road on the north side of the loch, with around one fifth cycling around Loch Katrine on their day of visit. The LL&TNP visitor survey 2003 found that of the visitors to the Trossachs generally, 25% were interested in walking, with the majority interested in low level walks of less than 2 miles and a further 12% were interested in other active pursuits. Loch Katrine also attracts family groups, due to the easy cycling on the private tarmac road and opportunities to combine a steamer trip in one direction with a cycle ride to complete a circuit between the Trossachs Pier and Stronchlachar. Because the shore road is the main focus of activity, there are some user conflicts between vehicular traffic, cyclists and walkers and the 1999 report found that 18% of cyclists had experienced some problems with other traffic. Additional walking routes in the area could help to alleviate some congestion and provide alternative opportunities for walkers, away from the lochside.

Hill walkers are attracted to the main summits such as Ben Venue, Ben A'an, Stob a' Choin and Beinn a Choin, via routes that can become damaged and eroded where use is high. This is the case with sections of the Ben A'an route at present.

2.15.2 Existing paths and links

The main route used at present is the shore road, which allows walkers and cyclists access to the spectacular landscape and views around the loch (see Map 5). The tarred road extends some 22 km to Stronachlachar and 3.2km beyond this to Culligart, after which a track continues on to Glasahoile along the south shore. Development of this into a round loch route as suggested in the draft IMP has since been discounted on the grounds of topographical constraints, public safety and nature conservation, as the intention is to manage land to the south of Ben Venue and Beinn Breach as a Natural Reserve area, with minimum intervention.

Existing Rights of Way (RoW) and Published routes within the area mainly provide access to hills and ridges for hill walkers, or reflect old drove routes. In practice, most of these routes, except those providing access to the summits of Ben Venue, Ben A'an or Beinn a Choin, are rarely used. These are shown on Map 5: Existing Access and Proposed Access and include:

South Loch Katrine

- A published route ascends to Loch Tinker, up the Cuillgart burn, with a return to the east, which rejoins the shore road at Coille Mhòr. There is no obvious path or signs that this route is used.
- An asserted RoW links the Royal Cottage to the B829 and the forest road to the north of Loch Chon at Faery Knoll. The route follows the line of the aqueduct and is marked by a series of archaeological features, but there is no obvious path, or indication that this route is much used at present.

North Loch Arklet

- A published route leads from Corriearklet, via Maol Mór to Beinn a Choinn, with a return via Stob an Fhàinne and Maol Odhar. This route is used occasionally by hill walkers.

Glen Gyle

- A published path and claimed RoW runs the length of the Glen Gyle valley and beyond to Inverarnan, with a spur to the Larig Glen (representing old drove routes). The route up Glen Gyle consists of a rough access track, but is rarely used, other than for management purposes.

North Loch Katrine

- Two routes lead from the shore road above East Portnellan via the Allt a' Choin valley to the top of Stob a' Choin and along the Meall na Boineide and An Garadh ridges to the top of Stob an Duibhe. Neither route is well used, or obvious on the ground.

Ben A'an

- A published RoW leads from the centre of Primrose Hill along the deer fence marking the top or the previous woodland edge, south-east to the top of Ben A'an. This route is very rarely used and the route down to the forest road is obstructed by the deer fence
- A little used RoW leads from the Ben Venue car park via the FCS Groddach block to join the Allt na Cailliche burn on the midslopes of Ben A'an, which it follows down to an inlet to the north of the Trossachs Pier.
- A more frequently used hill path ascends beside the Allt na Cailliche burn, to join the main Ben A'an path within the Groddach.
- A published RoW leads from the Trossachs Pier road along the tarmac road to the sluices. This is one of the main routes used to access Ben Venue, and forms part of a low level circuit, together with the alternative path through FCS woodland along Achray Water to Loch Achray House.

Ben Venue

- A RoW extends from the Achray Hotel via Bealach nam Bo to Glasahoile (old drove route). Two well used hill paths lead south-west from this route to the top of Ben Venue. The route through the woodland beside the Achray water is a made-up path.
- Two routes (a published and asserted RoW) lead south-west from Ben Venue to join at the col beside Creag a' Bhealaich. From there an asserted route heads south out of the catchment to Kinlochard. These hill paths are used infrequently by walkers.

2.15.3 Links to long distance routes outside the catchment

A number of the existing RoW, claimed RoW and published paths lead to destinations beyond the catchment. Those heading north and south follow routes which cross upland ridges and are of interest mainly to hill walkers. However, there

is scope for strategic links to both west and east of the catchment, into long distance paths and existing path networks.

The West Highland Way runs up east Loch Lomondside and is accessed via Glen Arklet. At present this involves using the B829, which is a major deterrent to both walkers and cyclists, being both narrow and heavily used by fast-moving tour coaches. The line of the old Military Road and 18th century road is shown in maps in Appendix 10. Although still visible on the ground, these roads are not obvious, or in current use. A feasibility study has been undertaken for the construction of a path following the old road lines, extending from the FCS forest road at Loch Chon through to an existing car park at Cruachan, near Inversnaid. This route is included in the ES proposals and would allow improved access between the two recreational catchments, as well as linking local settlements.

To the east of Loch Katrine lie other important recreational developments. The 4000ha Glen Finglas estate, owned by the Woodland Trust is managed primarily for native woodland and for informal recreation, with a newly constructed path network for walkers and mountain bikers. At present there is no direct access between Loch Katrine and Glen Finglas, other than via the A821.

Scope exists to create a direct link between the two estates via intervening FCS land at the Groddach. Routes to create such a link within the Groddach have already been planned and are subject to an ongoing ES process. Potentially it would be possible to link Loch Katrine via largely off road routes to Callander, one of the main tourist centres within the Trossachs. Possible routes include the existing Sustrans National Cycleway 7 south of Loch Venachar, or a proposed new route to the north of the loch. From the west end of Loch Venachar, the Queen Elizabeth Forest park can also be accessed.

2.16 Landscape Character Assessment

The landscape character describes an area in terms of all of the physical, ecological and cultural influences on the landscape. The draft NP Landscape Character Assessment (based on The Loch Lomond and the Trossachs Landscape Character Assessment, SNH, 2005) identifies a number of landscape character types (LCTs), nine of which are represented in the catchment area.

For each LCT, strategic aims and measures are recommended to maintain the integrity of each area in the face of ongoing change. The LCTs found within the catchment are summarised in Table 4, below. Within the catchment, a line which generally follows the 250m contour has been used to differentiate between areas described as hills and glens. This line follows a change in slope characteristics from steep and relatively smooth to very steep and craggy, reflecting underlying geology, the influence of glacial erosion and soils.

The high land within the catchment is represented by two LCT's, **Open Hills** and **Wooded Hills**, generally depending upon accessibility to grazing animals. Strath Gartney is divided into three LCT's, the glacially eroded glen sides are divided into **Wooded Glen Sides** and **Farmed Glen Sides**, depending on landuse and the valley bottom falls into the **Loch Shore Fringe** LCT. Tributary valleys entering Strath Gartney, including Glen Arklet, are designated as Upland Glens, which represent a further four LCT's : **Open Upland Glens**, **Wooded Upland Glens**, **Farmed Upland Glens** and **Freshwater Lochs**, where the valley floor is occupied by water, as in the case of Glen Arklet.

Upland: which includes Open hills and Wooded Hills, covers much of the area above the natural tree line, these LCT's includes a rugged landform of peaks, moorland, rocky outcrops, screes and gullies, dissected by a branched system of fast-flowing burns, waterfalls and lochans, forming the upper reaches of Upland Glens.

Glensides: the glacially eroded Glensides are often distinguished from valley floors and upland areas by marked breaks of slope. Slopes vary in steepness and some are craggy, with scree and rock outcrops. They are dissected by steep watercourses and typically reflect a mosaic of landuse, including Open, Farmed and Wooded Glen sides.

Strath/Glen Floors and Loch Basins: Prominent glacial features, with freshwater lochs differing from upland lochs through their important and significant Loch Shore Fringes.

Upland Glens: Narrow, U or V-shaped small or medium scale glens with fast-flowing water, draining upland slopes, or originating in lochans or corries. Valleys fall steeply and rocky outcrops, boulders and scree are common. The glens are subsidiary to main glens or other larger upland glens and their valley floors are not prominent features.

Table 4: Landscape Character Types found within the catchment area (adapted from the LL&TNP Draft Landscape Character Assessment)

LCT	Location and significance	Description	Opportunities and sensitivities
Upland- Open Hills	<p>Upper slopes, ridges and summits above 250m.</p> <p>Individual peaks and tops form significant landmarks and vantage points for panoramic views, with glimpsed views along associated glens. Includes rocky slopes below Ben Venue down to loch shore. One of the most extensive and visually prominent LCTs.</p>	<p>Cold, wet and exposed. Peaty soils predominate with bog, moorland and heathland and occasional tree/ woodland on lower slopes. Largely unenclosed land with relict features such as shielings. Footpaths tend to follow ridgelines; access limited to hillwalkers and stalkers</p>	<p>Conserve and emphasise open, wild quality;</p> <p>Use characteristic native species to soften transition between smooth and rugged ground;</p> <p>Maintain visual dominance of dramatic landform and steep craggy slopes;</p>
Upland- Wooded Hills	<p>Maol Mor, Allt Glasahoile and Ben A'an</p> <p>Limited LCT within the catchment, but often associated with Wooded Upland Glens and Wooded Glensides. Woodlands enhance glimpsed views and are an attractive component in the wider landscape.</p>	<p>Diverse tree dominated landscape, with smooth and hummocky hills, rocky outcrops, gullies and screes. Woodland is remnant semi-natural of varying densities and ages, including characterful windswept trees – some moribund. Land tends to be unenclosed, with few historic features (occasional shielings and extraction sites)</p>	<p>Encourage natural regeneration;</p> <p>Consolidate visual and ecological transition from wooded slopes to open hill;</p> <p>Encourage responsible access and open up selected viewpoints;</p> <p>Where woodland is expanded, conserve and enhance settings of historic features as part of a network of open space, reflecting the scale and integrity of past landuse.</p>

LCT	Location and significance	Description	Opportunities and sensitivities
Glensides - Wooded Glensides	<p>Mature woodland on lower north and south-facing slopes around Loch Katrine.</p> <p>Woodlands are locally enclosing and can obscure views across glensides, but provide an attractive feature in panoramic views</p>	<p>Semi-natural woodland along burns or across slopes, of varying density, with a heather or mossy understory. Some conifer plantations. Trees scattered and stunted at altitude, some areas moribund due to heavy past grazing pressure. Some woods with a history of management often contain associated archaeological features (charcoal platforms, bloomeries), also shielings and field systems.</p>	<p>Restore PAWS sites to native woodland; Consolidate visual and ecological transition from wooded slopes to open hills; Expand native woods and forest habitat network; Where woodland is expanded, conserve and enhance settings of historic features as part of a network of open space, reflecting the scale and integrity of past landuse</p>
Glensides -Farmed Glensides	<p>Farm units at Glasahoile, Culligart, Letter, Edra</p> <p>LCT of limited extent, but provides both visual focus and variety in the landscape. Can make a significant contribution to scenic qualities.</p>	<p>Glensides where land has been enclosed and improved for farming, with traditional dykes or more recent post and wire fencing. Pasture often invaded by bracken, scrub or rushes. Occasional farmsteads may be associated with small woodlands, buildings and traditional tracks and tend to occupy lower slopes where relict field systems also occur. Some have been abandoned.</p>	<p>Retain the visual and psychological diversity in the transition from human scale at lochside to wild expansive uplands; Encourage continued farming where feasible and reverse neglect of pasture and buildings; Where woodland is expanded, conserve and enhance settings of historic features and make this part of a network of open space, reflecting the scale and integrity of past landuse</p>
Glensides - Freshwater Lochs	<p>Loch Katrine and lochshore fringes</p> <p>The loch provides local identity, a visual focus and provides expansive and dramatic views to the wider landscape. Lochs are valued for tranquil and sensual qualities. One of the most visually prominent LCTs.</p>	<p>Open water and shoreline, with a fringe consisting of natural knolls, promontaries, sand or pebble beaches, woodlands meadows, open ground and reedbeds. Some retaining walls, gabions and causeways. The loch provides a water and recreational resource, with associated features - small settlements, boathouses, jetties and tourist facilities.</p>	<p>Improve sensitive access to lochshore at appropriate locations without compromising tranquillity; Retain and enhance the natural shoreline and the diversity in sequential views; Avoid new buildings, structures and new leisure activities on the loch or shoreline; retain the present scale of settlements and roads.</p>

LCT	Location and significance	Description	Opportunities and sensitivities
<p>Upland Glens - Open Upland Glens</p>	<p>Glen Gyle, Allt a Choin and Strone valleys. Important areas providing a visual and ecological connection from lower valley slopes to wider uplands. The glens allow views out of the enclosed landscape around the loch and. frame a number of classic views. Powerlines are prominent in views up Glen Gyle.</p>	<p>Medium V and U-shaped valleys, with heather on better drained land and moorland vegetation on acidic peaty soils and Scattered native trees found on ledges and along burn-sides. Upper areas tend to be open, but drystone dykes often denote enclosures at lower margins. Relict historic features include shielings, abandoned field systems and occasional farmsteads at the foot of valleys. Upland glens often provided historic communication routes such as drovers tracks. Paths and tracks follow burn-sides and can be very visible where they zig-zag onto summits.</p>	<p>Retain and enhance iconic views and ensure a visual and ecological balance between native woodland expansion and wider open space; Retain the wild character of upper slopes; Expand isolated native woodlands with medium density woodland cover, with density decreasing towards upper margins and natural features left clear of trees; Natural regeneration to be managed to complement new planting proposals; Historic remains to be managed as an integral part of the open space network.</p>
<p>Upland Glens - Farmed Upland Glens</p>	<p>Most of lower slopes around Glen Arklet and the Corriearklet valley This LCT occurs in relatively small pockets and can provide visual focus in the landscape, although extensive tracts of grassy vegetation along the loch lacks visual diversity. Power line is a prominent feature to the east,</p>	<p>Upland glen slopes that are sufficiently gentle to allow some improvement of pasture, with fields enclosed by traditional dykes or more recent wire fences, often in disrepair. Pasture often wet and invaded by rushes or scrub. Elsewhere, vegetation is generally wet moorland, with some heather. Occasional shelterbelts associated with isolated, frequently abandoned farmsteads, except where upland glens meet main glens. Historical communication routes, Military roads and drovers tracks follow such glens.</p>	<p>Enhance visual and ecological diversity of lower slopes; Conserve and enhance settings of historic features as part of a network of open space, reflecting the scale and integrity of past landuse</p>

LCT	Location and significance	Description	Opportunities and sensitivities
<p>Upland Glens - Wooded Upland Glens</p>	<p>Wooded tributary glen slopes, generally below 250m, including valley to the south-east of Loch Arklet.</p> <p>This LCT is often found below Wooded Hills and in association with Farmed Upland Glens</p>	<p>Pockets of semi-natural woodland, generally below 250m, including ribbons of trees from lochside to high altitude along burns. Low density trees become more scattered and stunted with altitude</p>	<p>Create more natural graded woodland to consolidate visual and ecological transition between woodland on lower hills and open upland areas; Where woodland is expanded, conserve and enhance settings of historic features and make this part of a network of open space, reflecting the scale and integrity of past landuse</p>
<p>Upland Glens - Freshwater Upland Lochs</p>	<p>Loch Arklet</p> <p>Lochs found in larger upland glens and often man-made.</p> <p>Loch Arklet is the focal point of views through the glen, with long vistas to the Arrochar Alps.</p> <p>Water supply infrastructure and roads in scale with the reservoir.</p>	<p>Open water often associated with unnatural shorelines where water levels can show significant fluctuations, drawn down sides very apparent after dry periods;</p> <p>Traditionally associated with water supply structures and little used for tourism.</p> <p>Distinctive Victorian architecture style for water supply infrastructure;</p>	<p>Improve opportunities to access the loch shore and associated views for quiet recreation;</p> <p>Improve loch setting with expansion of native woodland - ensuring the scale is in balance with the wider landscape and adds to visual and ecological diversity;</p> <p>Where woodland is expanded, conserve and enhance settings of historic features and make this part of a network of open space, reflecting the scale and integrity of past landuse .Avoid loch shore developments and those not in sympathy with current scale.</p>

3. DESCRIPTION OF PROPOSALS

3.1 Location

Works proposed take place within the area of Potential Woodland Expansion (PWE). Within the catchment, the 350m contour line has been taken as the effective limit to PWE, based on the existing tree line found in gullies, although it is likely that over time and in suitable locations, montane woodland will gradually develop above this line. PWE area covers 3656ha, excluding Lochs Katrine and Arklet, but ground conditions dictate that only a proportion of this area is actually suitable for woodland development. See Map 6: Woodland Proposals.

3.1.1 Bracken Control

Bracken will be controlled in situations where it is preventing desired natural regeneration, within or adjacent to existing woodlands or where it represents a major threat to other habitat types, as determined by monitoring.

3.1.2 Deer Control and Protection

Deer control will be undertaken throughout the catchment and deer fencing will be used to protect all new planting areas, with blocks individually fenced.

3.1.3 New Planting

Areas proposed for woodland planting are located on the mid slopes around both Lochs Katrine and Loch Arklet, with the exclusion of the Natural Reserve below Ben Venue and Beinn Breach. Planting areas generally lie between 175m and 340m. There are 35 separate planting areas in addition to woodland expansion work at Primrose Hill, Schoolhouse and Stronchlachar, covered by a previous ES. See Woodland Proposals Map 6 . New planting areas are numbered and their locations named as for areas given in section 2.2. New planting areas include areas:

- 1,2,3,4:** to the south of Loch Arklet
- 5 and 8:** along the boundary with Loch Ard Forest
- 6 and 7:** to the east of Loch Arklet
- 9,10,11:** to the south and south-west of Royal Cottage (south of Loch Katrine)
- 12 and 13:** south of Culigart and along the upper Culigart burn (south of Loch Katrine)
- 14,15,16:** Allt Glasahoile and Coille Mhor (south of Loch Katrine)
- 17,18,19,20:** to the north of Loch Arklet (20 is an extension to the

- 21: Stronchlachar WGS area)
south Glen Gyle
- 22 and 23: north Glen Gyle
- 24 and 25: east and west of Glengyle House
- 26: east of Boathouse Woods
- 27 and 28: west and east valley sides of the Allt A Choin burn
- 29: slopes north of Coilachra Woods
- 30: slopes above Schoolhouse Woods
- 31 and 32: to the west and east of Strone burn
- 33: to the north of Edra
- 34: east of the Letter Burn
- 35: west of Primrose Hill

3.1.4 Natural Regeneration

Within the potential woodland expansion area, three regeneration areas have been identified on the basis of available seed sources, ground conditions, and regeneration trial information collected since 2003. These include the western end of Loch Katrine, from the Allt a Choin burn, around to the north-east of Loch Arklet; an area to the south-east of Loch Arklet, and the lower slopes on the south shore of Loch Katrine between Ben Venue and Royal Cottage. See Map 6, Woodland proposals.

3.1.5 Woodland Management

Where required, regeneration coupes will be made, initially within Brenachoile Wood SSSI, but similar work may be extended to other other oak-dominated woodlands over time, if monitoring suggests that intervention is needed. Bracken control may also be considered to assist in regeneration.

3.1.6 Removal of Non-native Species

Work is required to remove rhododendron within the Ben A'an and Brenachoile SSSI and from slopes in the vicinity of Stronachlachar. There are also localised incursions into some woodland close to some of the houses around the lochs, which contain rhododendron within their grounds. Sitka spruce regeneration is an issue on Primrose Hill, and within Ben A'an Woods SSSI.

3.1.7 Conifer Felling and Conifer Retentions

Conifer felling is to be undertaken in the Primrose Hill, Schoolhouse, Boathouse and Silver Strand areas, as well as on the headland to the north of Stronachlachar. Conifer retentions are proposed mainly at Silver Strand, with small stands of Scots pine retained within Schoolhouse wood (WGS area) and of Douglas Fir around the site of the old Schoolhouse and at the eastern end of Boathouse wood. (See Woodland Proposals Map 6).

3.1.8 Access Works

New paths works are proposed at several locations around the catchment, including at Stronachlachar and Culligart and within existing woodland areas at Ben A'an, Primrose Hill and Schoolhouse. New access which will provide links outside the catchment is proposed along the line of the Military and 18th roads, with links to Inversnaid and Loch Ard Forest Park. (see Map 5 Existing and proposed Access).

3.1.9 Grazing

The intention is to re-introduce grazing management, using only or mainly hardy cattle. The primary aims are to improve management of open space habitats and to maintain a mosaic of open areas within and between woodlands, to control bracken spread and assist in the creation of conditions conducive to natural regeneration. Grazing will be concentrated in the potential woodland expansion areas, including some or all of the existing woodlands. Higher ground habitats (above 300m) will also be subject to grazing by deer.

3.2 Area Statement

At present 1376ha of the catchment is under established or developing woodland, representing 14% of the area. Of this area, at least 150ha consists of internal open space, in addition to unmapped open space located within the existing broadleaved area.

Over the next 150 years, the intention is to expand native woodland within the catchment to substantially increase the native woodland cover. By the end of the lease, the intention is to have about 3350 ha (or 35%) of the catchment under some form of woodland cover. This figure includes areas of relatively dense woodland as well as areas of low density woodland, including scattered trees and over 1000ha will consist of internal open space. A summary Area Statement is give below in Table 4.

According to a Habitat Action Planning (HAP) analysis undertaken by the FCS, based on purely ecological site considerations, if all suitable habitats were converted to woodland (including montane woods), about 73% (c7049ha) of the catchment could potentially support some form of woodland cover. In practice, this would not be desirable, or likely to occur without substantial intervention, and extensive areas will remain open due to poor seed sources, ground conditions unsuitable for regeneration and grazing pressure.

Table 5: Area Statement

Category	Net area ha.	Gross area ha.	% of area
Existing woodland			
Existing broadleaved woodland	890	890	9%
Conifer area (to be felled and converted to native woodland)	105	156	2%
Conifer area to be retained	17	17	not significant
WGS area managed by FCS (native woodland planting and regeneration)	210	313	3%
Subtotal of existing woodland	1222	1376	14%
Proposed New woodland			
New native woodland planting	800	1152	12%
Proposed expansion through natural regeneration	566	821	9%
Subtotal of proposed new woodland	1366	1973	21%
Other land			
Open land habitats		6248	65%
Subtotal other land		6248	65%
Subtotal gross woodland (new and proposed)	2588	3349	35%
Total Area		9597	100%
Note: Average internal open space within woodlands is 32%			

3.3 Alternative options for the site and choice of current proposals

The ICMP set out the objective for the catchment of expanding native woodland cover by 2000ha, with a substantial part of this to be achieved within a 20 year time scale. This objective was adopted as the basis of the lease agreement and constrains the available options for the site. Alternatives options for the site therefore relate to the means of achieving the required woodland expansion. In practice, three options were available:

- i. To rely solely on natural regeneration to achieve the required change in the balance of open ground and woodland.
- ii. To achieve 2000ha of woodland expansion solely through new planting.
- iii. To achieve 2000ha of woodland expansion through a combination of planting and natural regeneration.

In terms of location of the new woodland, a number of areas thought to be suitable for woodland expansion, based on soils, altitude and broad landscape impact were

identified the Interim Management Plan. Subsequent survey work has provided additional information regarding some factors (e.g. archaeology) or new areas of interest (e.g. geomorphology and landscape interpretation) and has led to these initial ideas being substantially amended. In addition to the hydrology surveys, archaeology survey, moorland bird survey, ESC and soil survey, habitat survey, geomorphology survey and other information collected on flora and fauna; natural regeneration survey plots were also established at various locations around the site. The supplementary information provided by these reports helped in the following assessment of proposals and options for the site:

Option 1: survey information showed that natural regeneration alone could not achieve the desired level of woodland expansion within realistic time scales. The distribution of the available seed source and evidence from survey plots and deer grazing suggest that much regeneration would be concentrated in South Katrine. Expanses of open hill in Glen Gyle, North Katrine and the Arklet catchment would remain in this state for the foreseeable future, through to a combination of lack of seed availability, soils and grazing pressure. The larger scale woodland habitat links envisaged are unlikely to be created by natural regeneration alone within the lease period. In addition to woodland distribution remaining largely unaltered, the resulting woodland composition would be heavily birch dominated and would take many decades to develop a more diverse species structure.

Option 2: expansion by planting would allow the greatest control over woodland distribution and location with respect to landscape objectives and protection of archaeological sites. It would also ensure that the objectives for woodland expansion could be achieved within the desired time scales. In biodiversity terms, the resulting woodland would have a tree composition more akin to a mature woodland, potentially creating suitable niches for associated ground flora plants, although their spread and ingress would be very dependant on other factors. However, the initial impacts would be high, due to the need for fencing and ground disturbance at planting and whilst naturalistic planting designs would be employed, there will inevitably be discontinuity between naturally developed and planted woodland. Whilst local genotypes would be used preferentially, given the scale of planting, availability of plants of local provenance or origin may be problematic. Finally this is a costly option and fails to capitalise on the regeneration potential of the existing woodland.

Option 3: achieving woodland expansion through a combination of planting and natural regeneration was considered to be the most efficient and effective means of achieving the catchment objectives. It will result in a more natural wooded landscape than could be achieved by planting alone, but will allow woodland to be extended to unwooded areas of the catchment at an appropriate scale. Areas likely to colonise through natural regeneration (of mainly birch) will provide an important link between existing and new woodland nuclei. Planting will also allow the introduction of a more varied range of species and woodland types than might otherwise develop.

Initial woodland expansion targets of 2000ha aimed to allow woodland expansion on a sufficiently large scale to create the forest habitat network links desired, although the area comprised less than 30% of the total potential area that woodland could occupy. Survey work has shown this 2000ha expansion figure to be feasible, but also suggests that it represents a realistic target in terms of the desirable extent of woodland, in the light of new constraints identified. Whilst in the long term, the 2000ha figure may be exceeded, it is intended that grazing pressure will be used to prevent detrimental impacts.

Initial proposals assumed 60% of the expansion could occur through natural regeneration. From information obtained regarding available seed source and likely rates of regeneration, it is now proposed that around 1150ha, (60% of the total) is achieved by planting. This level of planting is required to achieve the ICMP objectives within the 20 year timescale. It will also enable the introduction of species that are either threatened or missing from existing woodland communities; assist in improving the structural and species diversity of new woodland; and, in the longer term provide a seed source for developing woodland areas. It will also accelerate the creation of new forest habitat networks, which may be beneficial in the light of increasing concern over the impacts of climate change on woodland communities and the animals that inhabit them.

Other changes have also been made to the original proposals as a result of recent survey information. Planting area boundaries and locations have been amended to accommodate geomorphology features, as well as archaeological sites identified in the 2006 Headland survey; whilst proposals for paths and management access at two locations have been removed to take account of potential disturbance to wildlife and landscape impacts. The NP Landscape Character Assessment (draft) has also been used to refine and add detail to the landscape design process.

With respect to options for the remaining conifer areas, a detailed analysis concluded that retention of these areas would result in widespread windblow, with unacceptable impacts on soil stability, water quality and the landscape. For the more extensive conifer areas, felling to recycle would also result in long term negative landscape impacts as well as increase the possibility of the gradual spread of a naturalised spruce forest, against the objectives of the ICMP. For this reason, most of the conifer is to be felled and extracted, with small areas only retained for biodiversity or cultural reasons. Some limited additional road construction will be required to accommodate conifer extraction and is included in amended access plans.

3.4 Plan Proposals

In order to achieve woodland expansion at the proposed level and within required timeframes, a number of operations associated with habitat management and planting operations are proposed. These are listed below.

3.4.1 Bracken Control

Since the removal of sheep from the catchment, bracken is encroaching and spreading onto a range of other habitats. It also creates dense shade, thereby preventing or limiting natural regeneration. Bracken control is likely to be required on land with no trees, to create good conditions for regeneration; or around young growing trees, in order to help them become established. In some limited circumstances, bracken control may also be undertaken to protect key habitats if they are threatened.

3.4.2 Deer control and Protection

The site is populated by both red and roe deer. Roe are present in woodland throughout the catchment. Red deer occupy the open hill and woodland margins, but tend to move off the hill and down to lower ground around Loch Katrine in the winter. Since the removal of livestock in 2002, there has been evidence of considerable immigration into the Loch Katrine area. Both deer species represent a threat to new planting and regeneration. Due to the scale of proposed woodland expansion and the extensive nature of the site, it is proposed to protect establishment areas using a combination of deer fencing and population control.

To safeguard investment in planting sites, all new planting areas will be deer-fenced, as experience has shown that good establishment is unlikely to be achieved through population control alone. The planting boundaries on Map 6 show the indicative location of fence lines, although there may be some slight adjustments for local ground conditions. A total of 35 new exclosures will be created with extensions to existing deer fenced areas at Schoolhouse and the upgrading of the fence around Stronachlachar WGS area. Where fences are proposed within 1.5km of Black grouse leks, fences will be marked.

Areas designated as potential regeneration areas will be protected through control of deer populations. They will be monitored for damage annually and this information will be used to inform cull levels for the Deer management Plan. The catchment will be divided into areas north and south of Loch Katrine for the purposes of deer control, with different culls set in each area. Generally culling will be more intensive in the South Loch Katrine area, to protect forest areas to the south. To the north, culls will be set to achieve regeneration objectives, but the impact of culls on neighbouring sporting estates is also a consideration.

3.4.3 Species Choice

Habitat assessment work undertaken at Loch Katrine suggests the species most suited to the site will be Scots pine, Downy and Silver Birch with proportions of oak on the lower slopes near the loch. Minor species such as hazel, rowan, alder, willow, juniper, ash and aspen will also be included. Over time a natural treeline will develop which will include montane scrub woodland communities.

In practice, given the planting areas identified, the main woodland types planted will be W7 Alder-Ash woodland on wetter soils and W18 Scots Pine woodland on steeper more freely drained soils, with a much smaller area of W17 Upland Oak-Birch woodland. Much of the land suitable for W11 woodland is already under trees, whilst W17 and W4 woodlands, consisting mainly of birch can be expected to become established through natural regeneration. Table 6 below shows the NVC woodland types most suited to soils found within planting areas, and the approximate percentages of these NVC types to be planted.

Table 6: Relationship between soils in planting areas and proposed NVC woodland type (adapted from Rodwell, 1991)

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, pozdolic brown earths	Podzols, ironpans, peaty ironpans
NVC type to be planted	0%	23%	17%	19%	41%
Relevant LCTs	Component of other types	Open Hills, Open and farmed Upland Glens, farmed Glensides	Wooded glensides	Open upland glens and Farmed Upland Glens on steeper freely drained slopes to consolidate existing woodland on lower slopes	Open Hills on drier knolls

Table 7: Use of species within planting areas

Species	%	Comments on use
Silver Birch	6	Matrix species on drier soils
Sessile oak	20	On better drained soils, especially on areas of southerly aspect beside the road to be planted as potential productive oak woodland at higher densities of 1500/ha; otherwise on drier soils below 250m
Scots pine	41	To be planted throughout at slightly higher densities of 1200/ha to allow the possibility of some productive use
Aspen	2	As a minor component of all woodland types
Alder	20	To be planted on flushed, more basic areas beside water courses, also as slope woodlands at Loch Arklet
Ash	3	Matrix species on brown earth soils
Holly, Hazel, Elm, Juniper, Cherry (Wild and Bird), Grey Willow, Hawthorn	8	To be planted as minor species (approx.1% of each) as associated or understory species.

W7 Woodland will include alder and ash, with downy birch, goat willow, sessile oak, rowan, holly, elm and bird cherry as minor species. W17 will consist of sessile oak and downy birch, with silver birch, holly, juniper and rowan as minor species and W18 woodland of Scots Pine with downy birch, juniper and rowan as minor species. Downy birch, rowan and goat willow are expected to establish naturally throughout the area on suitable soils.

3.4.4 Ground Preparation

Ground preparation is required in planting areas and a combination of machine and hand methods will be used, with drainage undertaken only where deemed absolutely necessary. Where hand screefing is employed, herbicides may also be used pre-planting.

3.4.5 Planting

There are 35 separate planting areas around the two lochs, totalling 800ha. Within these areas, individual species will be matched to ground conditions. Within the new woodland areas open glades will be maintained for both ecological and visual reasons. Where vegetation cover denotes areas to be unsuitable for trees, planting will not be undertaken and areas of key habitats such as mire, bog or other important wetland mosaics within planting areas will be excluded. This approach replicates the existing mosaic of woodland and open areas and it is anticipated that

open space will vary between 30% and 50% in most areas, although could exceed this in some circumstances. Some areas will be planted at slightly higher densities to allow the possibility of some future timber utilisation; for Scots pine densities of 1200 stems/ ha will be used, with 1500 stems/ ha for productive oakwood stands. These denser oak stands will be located on the better soils and more accessible areas along the north shore of Loch Katrine. The remainder of the woodland types will be established at 1100stems /ha, with densities decreasing at altitude to mirror natural woodland development. In planting areas around Edra and Letter burns, lower densities of 200-500 stems /ha will be used, to reflect ornithological interests.

3.4.6 Fertilizer

Fertilizer will not be required for all areas of planting, but may be used on some of the more impoverished soils such as podzols and ironpans, to improve plant growth and survival.

3.4.7 Weeding

To minimise chemical inputs into the catchment area, chemical weeding will only be used in response to identified problems, with the need for weed control reviewed annually for all establishment areas. Chemicals used will include Glyphosate and Kerb for grass weeds; and Asulox and Glyphosate for bracken control bracken.

3.4.8 Natural Regeneration

Much of the proposed woodland expansion in the catchment is to be achieved through natural regeneration. Natural regeneration provides advantages for the conservation of local genotypes and in the development of woodland that is more natural in appearance, although in some locations the species mix may be limited by the available seed source.

A general policy of non-intervention will be followed in regeneration areas, to allow woodland to develop through natural processes. There are however two potential situations where some interference may be merited. Should vegetation become so rank as to restrict regeneration, some form of ground disturbance may be required. The preferred method is to use livestock to trample/graze such areas. Should livestock grazing not be feasible, hand or chemical screefing followed by enrichment planting would be used. Also there may be situations where planting of additional species (such as Oak, Scots pine, Hazel, Aspen and Juniper) would be considered to diversify highly birch-dominated regeneration.

At present, with no livestock and with the current deer density, a good density of regeneration (over 6000 stems/ha) is occurring in trial plots on the south side of Loch Katrine and Loch Arklet.

3.4.9 Woodland Management

Management works within existing woodlands will be undertaken for three main purposes - to ensure regeneration occurs, to control the spread of invasive non-native species such as rhododendron and Sitka spruce and to prevent damage to sites of archaeological or cultural interest within woodland areas. Within existing woodlands dominated by even-age stands of oak, oak regeneration and seedling recruitment is very poor. Whilst cessation of grazing may promote the development of a birch/rowan understory, in order to regenerate oak and diversify the structure of such stands, small regeneration coupes may be required.

Within Ben A'an and Brenachoile SSSI, proposed works are to remove invasive non-native species (rhododendron, Sitka spruce and Douglas Fir), remove trees and scrub encroaching on archaeological sites and to consider grazing with cattle to maintain the diversity of open habitats and prevent birch regeneration from colonising open habitats of value. Stock fencing of regeneration coupes may also be required, if grazing is re-introduced. Within Brenachoile, proposals include the felling of one regeneration coupe of c0.5ha every 5 years, in dense, unthinned oak above the road and to increase deadwood habitats by selective felling and topping or ring-barking of a small number of trees.

3.4.10 Removal of Non-native Species

The main invasive non-native species include rhododendron and Sitka spruce. Small amounts of self-sown Douglas Fir also occur. Rhododendron is widespread within Brenachoile Woods, with much seed originating in the grounds of Brenachoile Lodge, and to a lesser extent within Ben A'an Wood, above the car park. Extensive areas are also spreading across open hill slopes to the south-east of Stronachlachar. In 2002 11.3ha of rhododendron in Brenachoile woods was cut and sprayed, and in 2006/07 a further 26ha was treated, including regrowth from 2002 areas. There is an estimated 96ha of rhododendron within the wider catchment and about 80ha within the lease area. Eradication will not be feasible as long as seed sources exist. An ongoing programme of removal of invasive species will be instituted to deal with these problems. Felling of mature Sitka spruce blocks will also remove much of the seed source for this species.

3.4.11 Conversion of Conifer Areas to Native Woodland and PAWS Restoration

105ha of existing mature commercial conifer plantation within the catchment is to be felled. There is already some evidence of windblow at various locations, which brings consequent risks of erosion and sediment entering watercourses. The remaining trees are also seeding into adjacent native woodland restock areas. An analysis of harvesting options concluded that due to the terrain and consideration of the impacts of various methods of harvesting and extraction, skyline extraction to road would be required on steeper ground at Primrose Hill, with forwarding used elsewhere. Timber would only be felled to recycle where this would not result in unacceptable accumulations of woody debris.

Conifers on Primrose Hill, Silver Strand, slopes above the shore road at Schoolhouse and on the headland near Stronchlachar will be felled and extracted, whilst semi-mature conifers woodland at lower densities within mixed woodland and in mosaics with open ground on the lower slopes at Schoolhouse will be felled to recycle. All areas are to be restocked with native woodland species, supplemented by natural regeneration where this occurs. Extraction of timber from Primrose Hill will require some additional forest road construction at this location. For extraction of timber from Silver Strand, Boathouse and near Stronachlachar, construction of some additional transfer points/laybys will be required (see Section 3.4.14. below).

65 ha of the conifer area to be felled is classed as Planted Ancient Woodland Sites (PAWS - see Map 6, Woodland Proposals). The PAWS area includes 17ha of conifers, (stands of Norway Spruce, Larch and Scots Pine at Ben A'an, as well as two small pine stands within the Schoolhouse wood area, which are to be retained, due to the value of the mature trees as red squirrel habitat and to protect remaining ground flora interest. Douglas Fir stands along the shore road, associated with the Victorian heritage of the area are also to be retained for the landscape benefits they provide. All of these areas will be subsequently managed through group fellings or selective thinnings, to benefit remaining ground flora and ensure continuity of tree cover.

Stability permitting, the 17ha PAWs to the north of Ben A'an will be restored gradually to native woodland over a period of time through group fellings, or small coupes. The remaining 43ha of PAWS areas at Schoolhouse, Primrose Hill and Boathouse, as well as the headland near Stronachlachar will be felled and restored to native woodland by a combination of natural regeneration and supplementary planting. Most of these areas have little or no ground flora, having been densely shaded for the past 50 years. The headland has already experienced some windblow, and conifers at Boathouse and Glengyle House in close proximity to the road are beginning to show signs of instability.

Felling will be undertaken over a period of several years, with the small area near Stronachlachar, the potentially unstable conifers at Boathouse being removed during the first five year period; the large Sitka block at the west of the Schoolhouse area during the next five years; and felling on Primrose Hill undertaken within 10-15 years, probably in at least two phases. Work in areas to be felled to waste will be undertaken over a period of years.

3.4.12 Landscape Design

The overall design concept is to maintain and capture the essence of the “romantic Highland landscape” of water, craggy hill tops and wooded slopes and open hills, as described in the IMP (Appendix 2, Figure 7).

Design principles for the original woodland expansion proposals made in the IMP aimed to emphasise the diverse landscape, to enhance the visual and ecological transition between valley floor and open hill, to minimise the visual impacts of development and to enhance the setting of local features as well as to enhance both distant and closer views around the loch.

To ensure woodland expansion did not take place at the expense of landscape diversity, five different landscape approaches were proposed. The **Trossachs Wood** areas along the southern and north-eastern shores of Loch Katrine aim to reflect the Trossachs core landscape of wooded slopes and craggy landscape of hills and knolls at these locations. **Lochside** marks the transition from Wilderness to Trossachs Wood and applies to the remainder of the northern shore of Loch Katrine and the loch margin to the north of Stronachlachar and at these locations an irregular tree line will be naturally defined by crags, gullies and valleys, whilst the undulating lochside road will provide a variety of long views and changing local vistas. The steep slopes below Ben Venue and upper slopes above Loch Arklet around to Glen Gyle are to be **Wilderness** areas of steep rocky slopes and wetlands where only scattered woodland occurs. On lower ground on the north and east of Loch Arklet the Wilderness gives way to **Woodland in Open Space**, where long views over open ground are retained and framed by groups of trees. To the south of Loch Arklet, **Wooded Burns and Lochside** represents areas where woodland expansion up burnside seeks to add visual diversity and emphasis to the existing landform.

The more detailed opportunities and constraints identified for each of the individual Landscape Character Types (LCT's) identified (see Section 2.16, Table 4) have been superimposed over this broad canvass and been used to inform the changes to the original design.

Translated into woodland cover, slopes to the north-east and south of Loch Katrine will have denser areas of woodlands interspersed with light regeneration and open areas, in keeping with the woodland seen on the slopes of Ben A'an. (Views 25 and 26, Appendix 11a).

Around Edra there will be a transition area and across the long smooth broad valley slopes an area of very low density woodland, appearing as scattered trees kept below the ridgeline, and above relict settlement and enclosures occurring across the lowermost slopes. The open character and entrance to the Strone valley to the west of this area, will be retained. (Views 26 and 18). Schoolhouse woods will appear as a significant woodland area, approaching the ridgeline when viewed from Stronachlachar (View 11), but beyond this to the west, on the slopes above Coilachra, Portnellan and Glen Gyle House, more broken areas of woodland will spread from the lochside up the glensides and gullies, wrapping around the rocky spurs, and petering out towards the open upland moorland areas. (View 13). Scots Pine on the upper slopes will highlight the transition from the Trossachs-type woodland to the rugged uplands above. About 50% of the lochside will be kept open to allow good views across and along Katrine from the shore road and its viewpoints. Density of woodland will vary throughout all areas.

West of Glengyle house, woodland will clothe the lower flanks of the Glen Gyle valley, leaving open distant views, whilst broken hillocky ground to the north and east of Loch Arklet will contain groups of trees of variable size, similar in appearance to existing woodlands in the Wilderness area below Maol Mor, but extending these to the north-west (View 16a). In the Wilderness area, woodland regeneration will occur naturally as dictated by altitude, soils, landform and drainage. Planting will be used to enhance existing wooded slopes and create new discrete woodland areas above Stronachlachar and along the north of Loch Arklet to improve the setting of the village, increase visual diversity and maintain distant views along the open valley floor of Loch Arklet. Historic landuse, road and settlement patterns will be protected within open ground below planting boundaries (view 7). Along the southern slopes of Loch Arklet, denser woodland will be encouraged to spread up from the lochside, into gullies and onto better drained knolls between peaty flushes (views 4 and 5).

Along the south side of Loch Katrine, new woodlands will be used to consolidate and extend the upper margins of the existing woodland areas and create a natural transition between these and the conifer woodland of the Achray forest to the south. These woodlands along the upper margins above Royal Cottage will be more open due to the soil mosaics here, which contain appreciable areas of deep peat. (Views 16b, 17a and 19). Beyond these areas the Wilderness slopes below Ben Venue will be left unplanted to develop with minimum intervention (View 23).

In planted areas, woodland types will be matched to ground conditions to create a naturalistic landscape of wooded areas and open land. Woodland densities will vary, interspersed with considerable areas of open space dictated by soils and land form and the presence of archaeological sites. Tree cover will become sparser towards the natural tree line of around 350m, with montane woodland being allowed to develop where suitable conditions dictate above this altitude. Open heathland, craggy tops and mountain peaks will emerge above the woodlands. Open ground will be retained at lower levels as well as over extensive uplands and upland glen slopes and broad corridors will be maintained to link upland open ground through to lower open areas.

With the potential introduction of grazing, it is hoped that a dynamic landscape will emerge, using processes that have shaped wood pasture development in previous times.

3.4.13 Protection of Archaeological Features

A wide range of archaeological features, many related to historic settlement patterns are found throughout the catchment. As seen on Maps 4a and 4b, Archaeology Constraints, the lower boundaries of planting areas are generally sited above the old field patterns and enclosures. Relatively few structures are located within proposed woodland planting areas and almost all are isolated shieling huts. Where these do

occur, they will be protected by unplanted buffer zones, the width of which may vary for linear features. Within natural regeneration areas, archaeological sites will be monitored for encroaching tree cover, which will be removed at intervals to retain similar buffer zones.

3.4.14 Access Work

A general policy of open access will be encouraged across the catchment and responsible use of the area encouraged, although in some specific locations, negative impacts on wildlife through disturbance, or on the landscape through path erosion may require monitoring and some direct intervention. Resources will be put into education of the public, promotion of the area and provision of information and new facilities. A Visitor Management Plan will be prepared following a baseline Visitor Survey.

Proposed access works include those required to facilitate harvesting of the remaining conifer areas (see Table 8a below) and works to improve recreational facilities, described in Table 8b.

Improvements to recreational facilities proposed have been developed from information provided by consultees, during the ICMP production, and take into account recent visitor survey information regarding likely increases in visitor numbers and the fact that the majority of visitors who have come to the area are likely to prefer short circuits or walks that can be enjoyed in conjunction with other visitor attractions around the loch, and the interest in creating improved links to the surrounding area and specifically to the West Highland Way, to National Cycle Route (NCR) 7 and the Queen Elizabeth Forest Park.

Table 8a: New Access to Facilitate Harvesting Work

Primrose Hill		
Forest Road extension to access harvested timber	280m	280m extension eastwards from existing forest road with turning area.
Silver Strand		
Layby/transfer points to facilitate harvesting operation		Two layby/transfer points within Douglas Fir stand above the shore road .
Boathouse		
Laybys needed to facilitate removal of timber. The proximity of the conifer plantation to the road provides few options for provision of transfer points at this location.		Construction of 21 laybys (at 50m intervals) within woodland and on pasture land to the north of the shore road, to provide transfer points for timber and adequate passing places for vehicles and timber lorries.
Promontory to north of Stronachlachar		
Transfer point for timber harvesting		Construction of one transfer point for timber within felled area at the adjacent to the road.
TOTAL NEW FOREST ROAD	280m	

Table 8b: New Path works

Purpose of path/road	Length of new path	Description
Ben A'an		
Upgrade of existing subsidiary route to the top of Ben A'an to create a route through to adjoining land at FCS Groddach. As well as creating a range of local circuits, this will potentially form part of a link to the Glen Finglas path network via Tigh Mhor. Also, through this link, there is potential for connections to the Queen Elizabeth Forest Park and proposed long distance routes to Callander, including National Cycle Route 7 along south shore of Loch Venachar.	1140m	Upgrading of an existing desire line/hill footpath, with some local erosion, following the Allt na Cailliche burn from an inlet on the shore road c500m from the Trossach Pier. This will be upgraded to a maximum width of 1.2m using a combination of hill path and as dug construction methods.

Purpose of path/road	Length of new path	Description
Primrose Hill		
<p>Link paths to create several short loops and circuits above and to the west of Brenachoile, and also provide an alternative route back to the Trossachs Pier, via a link from the existing forest road to the Shore road at Silver Strand ; paths are accessed from the shore road at 3 locations and tie in with shuttle boat trips to Brenachoile jetty</p> <p>Higher elevation paths provide stunning views up and down the loch. Additional 2200m will open up a further 5800m of forest roads to access, creating several new circuits.</p>	2200m	<p>Extensions to the existing forest road network of high and mid level paths involving the construction of 1.2-2.0m wide as dug paths, connecting :</p> <p>a) the mid and upper forest roads</p> <p>b) the shore road east of Letter to the mid level forest road. The route follows an existing route that has been graded in places to allow off road vehicle access.</p> <p>c) the extended mid-level forest road, (see Primrose Hill forest road extension below) to the shore road at Silver Strand.</p>
Schoolhouse		
<p>Creation of short high elevation loop as an alternative to shore road through Schoolhouse Wood, accessed from the shore road at two locations to create a loop of 1840m.</p>	740m	<p>Construction of a 1.2-2.0m path extension from the existing road network to the shore road, through Strone Wood.</p>
Stronachlachar		
<p>Creation of a two short walking circuits around Stronachlachar, providing a useful recreational link at this end of the loch.</p> <p>The length of the longer route is 2750m, almost all of this path will use either the proposed military road or private tarred road, the length indicated is the new section required.</p> <p>The short loop of 870m, will use existing roads, the length indicated is the new section required.</p>	750m & 200m	<p>New 1.2-2.0m wide as dug path between the lochside road near the Aqueduct entrance and the Military road.</p>

Purpose of path/road	Length of new path	Description
Culligart		
Creation of an all ability path to a Black grouse viewing hide. The Culligart lek has seen a rise in the number of birds using the area. The provision of this path would allow disabled access to the site. Limited remedial work to an existing layby on the road to Culligart will allow up to 6 cars to park at the start of the route.	420m	New 1.2-2.0m wide as dug path or sections of board walks depending on the gradient and soils present.
Military Road		
Creation of a new path, providing safe off road routes for walkers and cyclists. This will link the settlements of Inversnaid, Stronachlachar, Aberfoyle and Kinlochard; create long distance links to the West Highland Way; the West Loch Lomond cycle route (via ferry link to Inveruglas) and to the QAFP forest road network. It will create a short circular walk from Stronachlachar and provide access between local tourist facilities (café, bunkhouse, cyclehire and pier) at Stronachlachar and Inversnaid. The route has been identified as a priority path in core path consultations, meets several priorities in the local Community Futures Action plan and safeguards and provides access to the historic road features.	9800	New 1.2m-2.0m wide path largely following the line of the Statute and Military roads. The path leads from the existing Rob Roy View car park, near Inversnaid, across the Arklet dam and along the northern Arklet valley side to a junction near the B829 junction, from which one leg of the road heads east to Stronachlachar and the other south to the FCS forest road at Loch Chon in the QAFP.
TOTAL NEW PATHS	15250m	

3.4.15 Grazing

Objectives for the site also include the maintenance of a livestock farming operation, provided this is not found to be detrimental to water quality. The primary reason for a farming enterprise is to retain site biodiversity and improve management of open space habitats, but also if possible to generate income. The original ICMP proposal was to re-introduce sheep, but the preferred option is to use cattle grazed on a wood pasture system, whereby higher ground is utilised in the summer and stock is over-wintered on low ground and within woodland areas. Cattle are able to control bracken spread better than sheep and their trampling exposes bare soil, providing better conditions for natural regeneration. As grazers rather than browsers, they are less damaging to developing woodland.

Cattle are unlikely to access land above 300m, and grazing of this area may also be required to retain biodiversity interest. This could be achieved by deer who both graze and browse vegetation. Deer are the favoured option, being a natural component of the ecosystem.

3.4.16 Monitoring

The progress and impacts of the work undertaken will be informed by a monitoring and review process. This will cover woodland management, biodiversity and landscape.

Woodland management will be addressed through the monitoring of planted sites, regeneration areas, browsing and deer populations; open ground communities and bird strikes will be monitored to assess biodiversity impacts and landscape change will also be monitored.

3.5 Work Methods and Design

3.5.1 Bracken Control

Where required, following preparation of a site plan and liaison with relevant parties, bracken control will be undertaken using a manual application of Asulam. Application rates will be 5-10 litres of product per hectare depending on whether it is early or late season. A non-chemical application buffer of 10m will be enforced for all watercourses and 20m from the lochside. Within these areas manual cutting or strimming will be used. Bracken may also be treated using the Glyphosate (Roundup, Biactive) at rates of 3 litres of product per hectare, depending upon season, however as a non-selective herbicide more care must be taken. Glyphosate is rapidly degraded and is relatively non-toxic to animals and aquatic life. The same non-chemical application buffers will apply.

Application of herbicides will strictly follow Field Book 8: The Use of Herbicides in the Forest (Forest Authority 1995) and *Forestry and Water Guidelines (4th edition)*, and instructions on labels will be followed at all times. Mixing and application will be supervised by a certified person. Herbicide will not be applied when weather conditions are inappropriate. No equipment will be washed out near watercourses of any size, and all chemical containers will be taken off site and safely disposed of via an approved contractor. A record of chemical application will be kept. Operators will have prepared a contingency plan for accidental spillages and will have available materials to contain and absorb spillages.

If grazing is re-introduced, this may provide an additional option for bracken control within certain locations, as trampling can be an effective means of reducing bracken cover.

3.5.2 Deer Control and Protection

Deer fencing will be used to protect native woodland planting. An estimate of the total fencing required, including upgrading the stock fenced WGS area at Stronachlachar is 35 kms. Standard red deer specification fencing will be used: 1.8m high, with high tensile net. Layout of materials will be by ATV, using pre-identified routes, with helicopter layout as a secondary option if constraints require this.

Fence lines will be chosen on the basis of practicality and to minimise visual impact and following current best practice. The fencing of individual blocks is generally necessitated by the presence of numerous, often deeply incised gullies, but also avoids erecting long straight runs of fencing across hill slopes, which can often be more conspicuous and prove a barrier to deer movement to lower ground. Wherever possible, fences will be routed down streamsides, along breaks of slope and avoiding skylines, along existing fence lines (which are often well-concealed), and away from paths and viewpoints. The very broken and hummocky topography found over much of the catchment aids the concealment of fences. Once planted areas are sufficiently established, a programme of fence removal will be instituted.

All fences within 1.5km of established Black Grouse leks will be marked using softwood droppers at approximately one per meter length, with extra stays to support the additional weight. Locations of fence lines will be chosen to avoid good feeding sites and flight lines into leks. All fence lines will be monitored and bird strikes noted. Should black grouse fence strike occur, fencing arrangements will be reviewed. If monitoring of Black grouse reveals the establishment of additional lek sites, fence marking arrangements will be reviewed.

Outwith fenced areas, protection of young trees and developing woodland will be through control of deer populations. For the purposes of deer control, the catchment will be divided into two areas – North and South Katrine and separate cull levels will be set for each area. Cull levels will be reviewed annually, based on data from aerial counts undertaken in spring, (annually, or at least 2-yearly) and on monitoring of regeneration condition/browsing, as described in the Deer Management section of the IMP. In addition, compensation culls of deer will be undertaken based on the relative loss of grazing area due to the construction of fenced enclosures. As far as possible, deer will be shot within season and management regimes will be adopted that minimise the need for out of season shooting on North Loch Katrine. A more intensive cull regime will be adopted in the south of the area, which may necessitate out of season shooting. In addition, some accompanied stalking will be undertaken within the catchment.

In all management operations affecting deer, the Deer Commission Scotland (DCS) Best Practice Guidance will be adopted as minimum standards.

3.5.3 Species Choice and Planting Stock

Local seed will be collected and grown on in a commercial nursery, to ensure local provenance as far as possible. Where this is not possible due to poor seeding of local trees, the next closest source of the required species will be collected, preferentially from within Regions 202 or 106, but at worst stock will be of a provenance with similar climatic conditions to the Loch Katrine area. For species such as Scots pine a local Biochemical Regional source will be chosen, probably Coilie Coire Chuilic.

3.5.4 Ground Preparation

A site plan detailing constraints and any special working practices will be prepared in advance of works. Fuel oils and lubricants will be handled and stored safely outside buffer areas. Refuelling and maintenance operations will be undertaken well outside buffer areas, and away from bridges and culverts. Bunded tanks and transfer hoses will be used to guard against spillages. Operators will have a prepared contingency plan in case of spillages or accidents and will have available materials to contain and absorb spillages. SW and SEPA will be informed of any incidents as soon as possible.

All suitable sites will be mounded prior to planting using an excavator moulder. A working system of ditch dolloping, 'hinge mounding' or inverted dollops (replacing the mound back in its existing spoil hole) will be employed. Machine dug 'V' drains may be used where there is a perceived need, but drains will end short of natural channels, ephemeral streams or old ditches. Machine mounding will follow local topography and this, in conjunction with open space within planting areas will prevent extensive areas of parallel mounds being visible. Use of tracked vehicles will reduce damage to the ground and travel through wet areas will be minimised. In areas where mechanical cultivation is not possible cultivation will be by hand screefing of a 30 x 30cm area. A pre-plant application of Glyphosate or Kerb may be considered, depending on weed growth and terrain, application rates and methods for this are covered under section 3.5.7 Weeding.

Buffer areas will be maintained, with no cultivation undertaken within 20m of burns over 2m in width, 10m for burns between 1 and 2m in width, and 5m for burns less than 1m; and trafficking within these areas kept to a minimum. Travel through and cultivation of areas of important open ground habitats, such as mires and deeper peats will be avoided and machine routes chosen to avoid water crossings wherever possible. Where such crossings are unavoidable appropriate measures will be taken to protect or minimise damage at crossing points. Local watercourses will be inspected regularly for evidence of sediment inputs and remedial action taken, if discovered.

3.5.5 Planting

All trees will be hand planted. Layout of materials will be undertaken by ATV, using pre-identified routes, with helicopter layout as a second option, if ATV access

is not feasible. Species will be matched to local vegetation and ground conditions, to recreate as natural a mix as possible.

Within planting areas, ESC has been used to identify suitable woodland types and species (see Appendix 12), and at the time of planting, species will be matched to ground conditions and local vegetation by experienced planters. Site plans will identify suitable density of planting at different locations/altitudes and also key habitats, such as mires that should remain unplanted.

3.5.6 Fertilizer

Phosphate will be applied to trees planted on leached mineral soils characterised by heathy vegetation at the rate of 32g granular phosphate or 36g ground rock phosphate per tree (applied to a 1m diameter spot around trees, post planting). On peaty gleys (excluding *Juncus* bogs) PK fertiliser (0:20:20) will be used at a rate of 50g per tree (applied to 1m diameter spot). Fertilizer will be laid out in bags to avoid leaching. Application of chemicals will follow Forestry Commission *Forestry and Water Guidelines (4th edition)*. All containers/bags will be taken off site and disposed safely. A record of chemical application will be kept.

3.5.7 Weeding

Weed control requirements will be reviewed annually. Site plans will be prepared and relevant parties informed in advance. For the control of grasses both Propyzamide (Kerb) and Glyphosate will be used as a pre, or post planting application on mineral or peaty gley soils. The overall volume of herbicide applied will be minimised by the use of one-metre spot applications for a maximum 3-year period. After this period the growth of the planting stock should be sufficient to ensure no further chemical application. Propyzamide will be applied either in a granular form or as a liquid in solution, the application rate will follow current guidance. Use of this chemical is limited to periods of cold weather, between 1st October to the end of February. No herbicides will be used within 10m of streams or watercourses, or 20m of lochs. Any weeding required within buffer areas will be carried out manually.

Application of herbicides will strictly follow *Field Book 8: The Use of Herbicides in the Forest* (Forestry Authority 1995) and *Forestry and Water Guidelines (4th edition)*, and instructions on labels will be followed at all times. Mixing and application will be supervised by a suitably trained person. Herbicide will not be applied when weather conditions are inappropriate. No equipment will be washed out near watercourses of any size, and all chemical containers will be taken off site and safely disposed of via an approved contractor. A record of chemical application will be kept. Operators will have prepared a contingency plan for accidental spillages and will have available materials to contain and absorb spillages.

3.5.8 Natural Regeneration

The main operations likely to be required to improve regeneration are grazing and bracken control, covered in sections 3.5.1 and 3.5.2. Enrichment planting may also be considered in the future, with hand or chemical screefing used as required.

3.5.9 Woodland Management

Work likely to be undertaken within existing woodlands includes the felling of small regeneration coupes; tree and scrub clearance around archaeological sites, bracken control and in some circumstances, enrichment planting to diversify species present. Grazing livestock may also be introduced. Use of chemical for weed or bracken control will be as noted in section 3.5.1 and 3.5.7; grazing will be monitored to avoid over grazing. Where work is undertaken in the vicinity of archaeological sites, these will be marked and advice sought from the Stirling Archaeologist where necessary, prior to works being undertaken.

Within the SSSI, removal of invasive species will follow methods in 3.5.10 below. Trees will not be felled within the vicinity of Wood Ant nests, or in the buffer zones of particular bird species during the breeding season.

3.5.10 Removal of Non-native Species

Site plans will be prepared and relevant parties informed in advance, where chemical are to be used. Remaining extensive areas of Sitka spruce are to be felled as described in section 3.5.10, this will assist in the removal of much of the seed source. Where conifers have spread into broadleaved woodland areas, they will be removed through either wrenching or overspraying, if small. Plants over 1m in height will be cut and the stump sprayed with Glyphosate, to run-off.

Rhododendron removal will be through overspraying regrowth from cut stems and smaller bushes under 1m, with larger bushes cut and burnt and their stumps sprayed with Glyphosate to run-off. Regrowth will be treated at regular intervals until eliminated. Stem injection of Glyphosate into larger bushes will also be trialed and this method used if it appears to be more effective. Within the SSSI, similar methods will be followed, but Mixture B may not be used. No chemicals will be applied within 10m of watercourses, or 20m of lochs. Any treatment within buffer areas will be carried out manually.

Application of herbicides will strictly follow *Field Book 8: The Use of Herbicides in the Forest* (Forestry Authority 1995) and *Forestry and Water Guidelines (4th edition)*, and instructions on labels will be followed at all times. Mixing and application will be supervised by a certified person. Herbicide will not be applied when weather conditions are inappropriate. No equipment will be washed out near watercourses of any size, and all chemical containers will be taken off site and safely disposed of via an approved contractor. A record of chemical application will be kept. Operators will have prepared a contingency plan for accidental spillages and will have available materials to contain and absorb spillages.

3.5.11 Treatment of Conifer Areas and PAWS Restoration

Most conifer areas will be felled and the timber extracted; areas with more scattered trees will be felled to recycle. To minimise harvesting impacts on soil, a combination of forwarding and skylining (at Primrose Hill) will be used, with extraction of timber by road. The alternative of extraction by helicopter has been discounted for all areas on the grounds of health and safety and disturbance to users of the area (see Appendix 14).

Liaison will be undertaken with interested parties at the planning stage, and the best machinery combination chosen for the ground conditions. Operations will generally be scheduled for the drier summer months, unless other constraints exist. Felling at Boathouse, adjacent to the shore road will need to be undertaken outside the main tourist season to minimise impacts on road users.

A site plan detailing constraints and any special working practices will be prepared in advance of works and presence of priority species checked for before any work commences. For bird species, FCS Guidance note 32 *Forest operations and Birds in Scottish Forests*, will be followed. As far as possible felling will take place outside bird breeding seasons, although this will not always be possible as this may conflict with periods when felling will have least impact on ground conditions and water quality. Where felling during the nesting season is necessary, areas will be checked in advance of works and measures taken to minimise disturbance. Timing of operations will also take into account the presence and possible disturbance of sensitive or rare bird species, with safe working distances applied where necessary.

Fuel oils and lubricants will be handled and stored safely outside buffer areas. Refuelling and maintenance operations will be undertaken well outside buffer areas, and away from bridges and culverts. Bunded tanks and transfer hoses will be used to guard against spillages. Operators will have a prepared contingency plan in case of spillages or accidents and will have available materials to contain and absorb spillages. SW and SEPA will be informed of any incidents as soon as possible.

Heavily used access points and soils liable to compaction damage will be protected by brush, logs or stone and extraction routes will be chosen to minimise stream crossings. Where these are unavoidable, suitable measures will be taken to minimise damage, with pipes or log bridges used where required. Trees will be felled away from streams and branches and tops kept out of watercourses. Extraction routes will be minimised on steep ground, and offlets used to divert water from routes where necessary. Where cable crane extraction is used, the formation of worn trails will be avoided. Brush and timber stacking areas will avoid wet ground and buffer areas and bunding will be used where sediment run-off is likely to occur. Watercourses will be regularly inspected for evidence of sediment inputs and remedial action taken, if discovered.

The only additional roads at present identified /required are an extension to the forest road at Primrose Hill, with some additional laybys along the shore road at Silver Strand, Smithy and Boathouse for passing places and for loading bays in the case of Boathouse (see section 3.5.14 for details).

Felled areas will be restocked with native woodland species using Ecological Site Classification (ESC) models and ground flora to identify suitable woodland types and species. Establishment techniques, planting densities and retention of open space and weeding will be as described in sections 3.5.3-7. Planting will take place after a minimum fallow period of five years, to avoid the need to use pesticides to protect against beetle and weevil damage to transplants.

It is anticipated that felling work will be phased over a period of years, with conifer areas showing signs of instability or roadside areas where instability could pose a risk to visitors being removed within the first five years. These areas include the headland near Stronachlachar, Boathouse woods and conifers above the road and to the west of the open ground at Schoolhouse wood. Conifer areas to the east of the open ground at Schoolhouse and below the road, as well as the Primrose Hill PAWS and non PAWS felling are expected to be undertaken in the following five year period. Provided it remains stable, the Ben A'an PAWS area will be retained for at least 15 years and then removed successively as a series of small coupes, to protect ground flora of value.

3.5.12 Landscape Design and open space

Proposals have been designed to take account of the main landscape sensitivities highlighted in the scoping report (quality and extent of specific/iconic views; impacts on the mosaic of open upland glen and wooded slopes; impacts on more extensive open upland glens contributing to the wild and remote qualities of the area and impacts on locally significant pockets of open ground providing the setting for natural and cultural features in the area). In general, planting beside Loch Katrine has been designed to integrate existing forest, woodland and open space, whilst planting along Loch Arklet has been designed to create a new native woodland structure.

A total of 22 primary and 8 secondary specific and iconic views have been identified, including long and local views within and around the catchment, as well as viewpoints from distant roads used by tourist traffic and hills and peaks popular with hillwalkers. These are included in Appendix 11b.

For each viewpoint, the proposals have been shown as annotated visualisations, which illustrate the landscape context, policy guidance and analysis used in the development of proposals for woodland planting, tracks and roads. Visualisations show the woodlands at the end of the establishment phase (30years) and at maturity (60 years). The methodology follows the Forestry Commission's Guidelines for Landscape and Visual Impact Assessment (2nd edition). All assessments were subsequently checked by a second Landscape Architect.

The full Landscape Assessment and analysis of the impact of proposed planting and woodland expansion is provided in Appendix 11a and associated Tables. In all cases, woodland expansion proposals have followed guidance provided by the draft

Loch Lomond and the Trossachs NP Landscape Character Assessment. The 22 primary and 8 secondary viewpoints are described in the table below and show the impact of all woodlands, including the 1997 WGS woodland expansion works as well as existing and proposed new woodland. Most viewpoints are existing well-used locations around the lochs, however, views from points 2, 3, 4, 5, 6, 22 and 23 will be opened up by the establishment of new access.

Table 9: Landscape Assessment Viewpoints (* indicates minor viewpoints)

No	Viewpoint	View
1	Glen Sloy track, west side of. Loch Lomond	Distant view east through Glen Arklet (areas 1,2, (3), 7,17,(18), 19) ; with Coilachra and area 29 and Schoolhouse WGS and area 30 in the distance.
2	RSPB car park at proposed end of Military Road, west end of Glen Arklet	South towards Cruachan and the eastern edge of planting area 1 (south Loch Arklet)
3*	Boathouse on north shore at western end of Loch Arklet	West to the Arrocher Alps and Ben Ime showing western extent of planting areas 1 and 17 (west Loch Arklet).
4	From Military Road, west of Corriearklet, north Glen Arklet	South-west to Cruachan and area 1 (south Loch Arklet)
5	From Military Road above Corriearklet (Glen Arklet)	South, viewing planting areas 1,2,3,4 on the slopes to the south of Loch Arklet
6*	From Corriearklet on the north shore of Loch Arklet	East south east across the eastern end of the loch to the lower slopes of Beinn Uamha and the boundary with Achray Forest -areas 3,4,5,8, (7)
7*	From top of Beinn Uamha (south of Loch Arklet)	Panoramic view to the north of Loch Arklet and northern tip of Loch Katrine, including planting areas 1 (eastern end), 2,3,4 in the foreground , 17,18,19 20 and Stronachlachar WGS; and 26 (east of Bothouse woods) in the distance
8	From the east end of Loch Arklet (layby on B829)	West through up Glen Arklet to the Arrocher Alps showing planting areas 4, (3), 2, 1, 17 and 19
9*	From the north east end of Loch Arklet	View north towards Garradh and woodland above Stronachlachar – existing native woodland and WGS planting and new areas 19 and 20
10	From the B829 as it enters the catchment to the east of Loch Arklet	Enclosed view along the road towards Garradh, above Stronachlachar. Only area 7, designed to reduce the visual prominence of pylons, is visible

No	Viewpoint	View
11	Stronachlachar pier	Panoramic views to Ben Aan eastwards along Loch Katrine, showing woodlands on both the north and south sides of the loch. Includes existing woods and WGS at Schoolhouse with areas 29 and 30 and Primrose Hill WGS beyond on the north and Culligart woods and area 15 to the south.
12	From the steamer approaching Stronachlachar pier	North west towards the slopes of Garradh above Stronachlachar and existing woodland, areas 6, 19 and 20
13	From the Dhu north Loch Katrine	Across the northern end of Loch Katrine to Glen Gyle House and the slopes below Meall na Boineide, with existing woods, planting around Glen Gyle House and Boathouse (24), 25, 26; with Allt a Choin – areas 27, 28 (29) in the distance
14	North end of Loch katrine	Up Glen Gyle, with planting areas 21,22, 23 on the lower valley slopes
15*	From the headland at Coilachra	East across Katrine to Stronachlachar pier and slopes above - areas 7, (8), (19), 20, WGS and existing woodland; with the east end of loch Arklet and areas 2,3,4 in the distance
16a	Meall Dearg, above Coilachra	West across Katrine to Meall Mor and areas 4,19, 20, WGS, 21 and existing woodland; with 29 in the foreground
16b	Meall Dearg above Coilachra	South west across Katrine to the Loch Ard forest boundry with areas 1 and 4 (south Glen Arklet) in the distance; the existing Royal Cottage woods and areas 5, 7,8 and 9 on the site boundary; and areas 19, 20 and WGS above Stronachlachar
17a	Katrine viewpoint (Schoolhouse headland)	South-west to Royal Cottage woods and areas 8, 9, 10,11 and 12, as well as planting and WGS at Stronachlachar
17b	Katrine viewpoint (Schoolhouse headland)	View east to Ben A'an, with Primrose Hill WGS and the east end of 30 in the distance); Schoolhouse WGS in the foreground; and existing woodland,
18	Glasahoile track, east of Culligart	View across Katrine to Schoolhouse woods, WGS and 30; the Strone valley (areas 31 and 32) and Edra (33)
19	Edra	View to southern slopes below Beinn Breach and Ben Venue, Glasahoile woodland and areas 15 and 16 above existing woodland
20*	From mid Loch Katrine	To Brennachoile lodge and Primrose Hill WGS with area 35

No	Viewpoint	View
21	From forest road at western edge of Primrose Hill	Panoramic view over Loch Katrine with existing woods, 15 and 16 across the loch and areas 33, 34 and Schoolhouse beyond Primrose Hill WGS in the foreground
22*	Forest road, mid Primrose Hill	View west through Glen Arklet to Beinn Ime: across Primrose Hill WGS and areas 34 and 35 to low density planting in the Strone and Letter valleys (31, 32 and 33) to Schoolhouse WGS and 30; with existing woods and new planting between here and Royal Cottage visible across the loch.
23*	Forest road, mid Primrose Hill	View south across Craig Leven to the Achray Forest showing Primrose Hill WGS and PAWS restoration areas
24a	Brenachoile point	Panoramic view west through Glen Arklet to the Arrochar Alps, and existing wood and planting at Schoolhouse and Stronchlachar WGS seen in the distance
24b	Brenachoile point	East to Ben A'an, showing Primrose Hill WGS and PAWS restoration area
25	Steamer near Trossachs pier	View to Primrose Hill showing Primrose Hill WGS
26	Ben Venue	Panoramic view over Loch Katrine, and area 15 in the foreground; and north lochside woodlands from Primrose Hill to Coilachra – Primrose Hill WGS and planting areas 34, 35; low density planting at Edra and Strone valleys (31-33); Schoolhouse WGS and 30; with areas 21-29 in the far distance
27	Ben A'an	Panoramic view along Loch Katrine with Primrose Hill WGS (foreground); 31-33 planting areas; Schoolhouse WGS and area 30; with Stronachlachar WGS and Loch Arklet planting in the far distance

3.5.13 Protection of Archaeological Features

Surveys have located archaeological sites within the zone of woodland expansion. Proposed planting boundaries have been altered where necessary to avoid damage to sites or to their settings in the case of field patterns and enclosures. Protection of sites elsewhere will be in accordance with advice in the Forestry Commission's Forests & Archaeology Guidelines.

a) General protection of sites in the vicinity of works

Archaeological features in the vicinity of any proposed works such as harvesting, ground preparation, new planting or access works will be marked on site prior to works commencing.

All access for works, including extraction routes, processing areas, loading bays, parking, storage or fuelling areas, as well as the line of proposed new paths will be sited to avoid archaeological sites. Where crossing linear features such as dykes is unavoidable, lines will be chosen to minimise damage and dyke ends will be rebuilt. When sites lie close to recreational access routes, and interpretation is proposed, potential impacts of increased visitors to the site will be assessed.

Any new sites located during works will be brought to the attention of works supervisors, and work in these areas suspended until appropriate protective measures are put in place. New sites will be added to the constraints map.

b) Protection of sites within woodland expansion areas

Archaeological sites within new planting areas will be protected by an unplanted buffer of 20m and where a group of features exist, they will be buffered together. For linear features, such as dyke sections, a variable buffer width of 8-20m will be retained to avoid a wayleave effect. Sites located within areas designated as natural regeneration or planting areas, or potentially at risk within existing woodlands will be monitored at 10 yearly intervals, to check for encroaching vegetation and this will be removed if necessary.

c) Specific protection in harvesting sites

In situations where timber located within an identified site is to be felled, the site will only be worked during dry conditions and brash matting used to protect the site. On sites where trees are to be left on or close to archaeological features (such as at the site of the old Schoolhouse); trees will be monitored at intervals and any showing signs of instability will be removed to avoid causing damage.

d) Protection of Military and Statute roads during new path construction

The specification for the new path along the Military and Statute road lines was completed after an archaeological dig and assessment of these features had been made. This found that as relatively little road formation existed, the preservation of the line and setting of the route was more important than preservation of existing physical surface and deposits. As far as possible, the new path will follow existing road lines, old culverts and bridge footings will be preserved, limited existing sections of pitched path restored and fords retained. Although the new path will be narrower than the original, ditches will be dug to correspond to the older road formations, using original ditches where possible. For construction works, small machinery (mini-excavators and powered barrows will be used to minimise the corridor of work and any damage to the road settings.

3.5.14 Access

a) New paths

Paths to be constructed are described in Table 8b in section 3.4.14. In general these will be constructed in accordance with FCS *Forest Management Guideline No.6, Design and Construction of Access Tracks*, with the exception of the Military road, for which a detailed specification has been prepared. Most paths will be of 'as dug' construction, using local material won from cut and fill areas, drains and if required small borrow pits along the route. Constructed paths (such as required for Ben A'an) or pitched sections will only be used on steeper side slopes, very rough ground, or where the long gradient of the path is greater than 55%. In these sections, work will be undertaken in accordance with guidance in the SNH *Upland Path Construction Standards for Scotland* (1999).

Path routes will be chosen where possible to avoid steep side slopes, very flat ground, wetland areas, areas of important habitats and archaeological sites and water crossings will be minimised. Landscape impacts will be minimised by using dead ground, varying curves and gradients to reflect the land, avoiding long straight parallel or horizontal alignments and crossing the faces of spurs and ridges, following existing vegetation boundaries to help hide the line and where skylines are crossed, doing this at the lowest point.

Organic material, vegetation and topsoil will be stripped for re-use. Cut and fill will be balanced as far as possible and where borrow pits are needed, these will be infilled and graded after use. The track surface will be narrowed to the required width of 1.2-2.25m, this width to be minimised on steeper cross slopes and formed to fall to a topside drain where present, or cambered, using appropriate subsoil material. Side slopes above and below the path will be finished to a natural profile, not exceeding the local angle of rest and rounded at top and bottom to avoid overhangs, and dressed using set aside topsoil and turfs. Where rock is left exposed, cuttings will be irregular to mimic natural rock. A topside ditch (minimum 300mmx 300xx) will be dug on path sections that are wet or have side slopes, with water directed off at low points, but not into existing drainage channels or watercourses. Drain flow is to be checked where long gradients exceed 6.5%.

Water crossings will be made using a combination of stone fords for ephemeral water courses, piped culverts for running water courses or low points, with stone built splash plates and headwalls and to hide pipe ends. Pipes will be twin-walled, of sufficient size to accommodate peak water flows. Stone cross drains will be used where bed rock outcrops close to the surface. For all major watercourses and deeper gullies, bridges will be constructed. For all water crossings shown on the 1:50,000 OS map, SEPA permission will be obtained, as per CAR regulations. Technical specifications are included in Appendix 13.

b) Military road

Path construction will be in accordance with guidance in the SNH *Upland Path Construction Standards for Scotland* (1999). 8175m of the 9.8km path will be constructed within the catchment lease area, with the remainder on FCS land in Loch Ard Forest, and a short section across the dam at the western end of Loch Arklet on land retained by Scottish Water. Small scale machinery (mini-excavator and powered barrows) will be used to minimise the working corridor and to minimise impacts on the original road formation and the setting of the road.

Organic material, vegetation and topsoil will be stripped for re-use on regarded verges to minimise landscape impacts and speed the process of vegetation establishment and any waste material spread at agreed locations to minimise adverse impacts. The finished path will be 1.2m-2.0m in width, with an unbound aggregate surface, typically using 150mm quarry scalplings, from a local source that will blend in with the landscape, with a geotextile underlay on wet or softer sections. Most of the length will have ditches on both sides. These will be dug to correspond to the original Military and Statute road formations, using old ditch lines where possible. A combination of stone and piped culverts will be used, with stone headwalls constructed to obscure pipe ends. Two 6m bridges are required, including a 2m wide crossing over a burn near the boundary by the Rob Roy View car park and a second to cross the Corriearklet burn. Detailed bridge specifications have not yet been produced, but original bridge footings and fords will be retained where possible and final bridge design will be sympathetic to the scale and setting of the route. Where the road crosses fencelines, self-closing gates suitable for all path users will be erected.

c) Roads/loading bays

To facilitate extraction of timber, 280m of additional forest road and an associated turning area will be constructed at Primrose Hill; whilst new transfer points/laybys will be constructed along the shore road at Silver Strand; Boathouse and at the headland near Stronchlachar (see table 8a in section 3.4.14 for details).

The construction of the road will reflect harvesting targets and it is intended that the additional road section on Primrose Hill and the construction of 21 additional laybys/transfer points is completed within the first five years. Construction methods and standards for forest roads and laybys will follow guidance in the FC Civil Engineering Handbook and are detailed in Appendix 14.

In general, a road corridor of 25-30m will be cleared of trees to allow for the width of the running surface of the road, together with verges, embankments and ditches and to assist in future road maintenance. Vegetation and soil will then be stripped to expose the bare substrate.

The road formation will be a minimum width of 6.0 metres, including the running surface and the batters (i.e. embankments). The formation width will be increased proportionately for bends and passing/turning places. Where the road runs across a slope, the road will be aligned to minimise excavation. The batters will be as steep

as possible to minimise this footprint, provided stability is not compromised. The actual detail of side slope formation will be determined once trees have been removed. The final effective road surface width will be 3.4m on straight sections, wider on curves of less than 90° radius.

Roadside drains will have a depth of not less than 450 mm below the formation edge and a longitudinal gradient of not less than 2%. Catchpits, settlement ponds and filters will be provided in and adjacent to the drains to avoid pollution and sedimentation of watercourses.

Excavated material will be used to build up the road surface where required and suitable material will be retained on site and used to landscape exposed cuttings or embankments. Surplus material will be removed from site. After a period of consolidation, the road will be surfaced with suitable compacted stone, won from within the road corridor with additional material required being sourced from the Borrow Pit within the Achray forest.

Watercourses will be disturbed as little as possible during road construction. The existing drainage pattern will be retained. The road extension will require two small streams of less than 1.5 metres in width to be culverted, with culverts following the original line of the stream-bed. The design of culverts and bridges at Primrose Hill would be in accordance with the Scottish Executive guidelines detailed in *'River Crossings and Migratory Fish: Design Guidance'* (2000). During bedding and pipe laying, the excavation will be bunded to avoid inundation. If pumping is required to remove excess water; then the discharge will be passed through settlement ponds and/or filters before re entering the watercourse.

Avoidance of water pollution will be a priority when constructing and maintaining roads and standard measures outlined in the *Forests and Water Guidelines, Fourth Edition* (2003) to minimise erosion and transfer of soils and materials into watercourses will be followed. Accumulated surface water on the formation will be regularly routed into adequate catchpits/silting lagoons during construction. Fuel oils and lubricants will be handled and stored safely outside buffer areas. Refuelling and maintenance operations will be undertaken well outside buffer areas, and away from bridges and culverts. Bunded tanks and transfer hoses will be used to guard against spillages. Operators will have a prepared contingency plan in case of spillages or accidents and will have available materials to contain and absorb spillages. In the event of any sizeable spillage or pollution of any watercourse the the "Action Plan for Fuel and Oil Spillages" will be implemented immediately and SW and SEPA will be informed of any incidents as soon as possible.

3.5.15 Grazing

Should cattle grazing be introduced, it is likely to involve the introduction of a suckler herd, composed of hardy breeds such as Highland, Galloway or Ling, able to forage hard and survive out of doors with minimal winter feeding. A mid-April to mid-June calving pattern would be favoured with cows crossed to a traditional beef

breed, such as one of the Shorthorn breeds or Aberdeen Angus to provide saleable calves and potentially replacements, if they prove suitable for the conditions.

The expected carrying capacity of the land would indicate a herd of some 200 head, however numbers would be built up gradually. Ideally the herd would be split into 4 or 5 smaller units, each with their own bull and own handling facilities.

Other grazing systems may however be adopted and will depend upon impacts on water quality, vegetation and the condition of existing and expanding woodland and the practicalities of managing and servicing such an operation. The use of sheep in the future is not foreseen under present circumstances, but has not been discounted.

At present all internal fences have been assessed for condition and will be retained, until such time as grazing plans are finalised. A fencing programme will then be instituted.

3.5.16 Monitoring

Monitoring will be used to assess both performance and long term impacts of the proposals for the site and will involve the following:

a) Woodland monitoring:

- Planted sites: sample plots will be monitored after the first and fifth season to assess density against the aim of achieving 1100 trees/ha (or the local target density, if different).
- Regeneration areas: trial plots and transects will be assessed annually for tree species and size class, distance from seed source, ground conditions (damp or dry), ground vegetation damage to trees from browsing and photographs will be taken from each transect. Plots will be assessed against the aim of achieving 1100trees/ha.
- Browsing: damage to key indicator trees will be assessed using 43 paired plots, with trees inside a 1m² enclosure being compared for leader damage with the control outside. In addition, a general condition assessment will be made of developing trees.

b) Biodiversity monitoring:

- Bird strike: All deer fences will be walked at least once per year and bird strikes mapped. Results will be used to assess whether additional marking or early fence removal should be considered.
- Open ground plant communities: the baseline NVC assessment of 2006, will be supplemented by the development of a 5 yearly monitoring system based on key indicator species to assess the quality of various key habitats.

c) Landscape change:

- Fixed point photography from key viewpoints at 5 year intervals will be used to assess the landscape impacts of woodland expansion, especially on sensitive viewpoints and will be used to determine future landscape works and to assess whether medium and long-term targets are being met.

3.5.17 Standards of Work

All work will strictly comply with the *UK Forestry Standard 2nd Edition*, *UK Woodland Assurance Scheme (UKWAS)* and *UK Forestry Stewardship Council (FSC)* standards of management.

In addition, for ground works, road and path construction, harvesting work and the application of chemical herbicides or fertilizer, the Forestry Commission's *Forest and Water Guidelines (4th Edition)* will be followed as well as the *Cowal and Trossachs Pollution Control Plan 2005*. For herbicide applications, guidance in *Field Book 8: The Use of Herbicides in the Forest* (Forestry Authority 1995) will be used.

For works in the vicinity of archaeological sites; advice in the Forestry Commission's *Forests and Archaeology Guidelines* will be followed.

For works that may potentially affect breeding birds, FCS Guidance note 32 *Forest operations and Birds in Scottish Forests* will be followed.

Path construction will follow FCS *Forest Management Guideline No.6, Design and Construction of Access Tracks* (Appendix 13) or *SNH Upland Path Construction Standards for Scotland* (1999).

Road construction work will follow general guidance in *FC Forestry Civil Engineering Handbook (2000)* and specific guidance in the *Scottish Executive River Crossings and Migratory Fish: Design Guidance (2000)*.

For any works affecting water crossings which are shown on 1:50,000 OS maps, CAR regulations will be applied.

4. IMPACT PREDICTION, ASSESSMENT AND MITIGATION

This ES is required to assess the impacts of proposals for Loch Katrine on five issues: the role of the area as a public water catchment, the landscape, conservation of key habitats and species, deer and archaeology. Proposals include large scale woodland expansion by planting and natural regeneration and associated deer control, felling of conifer plantations and removal of non-native species, some woodland management, access works and potentially some grazing of livestock.

4.1 Public Water catchment

The 9597ha catchment lease area drains into Loch Katrine, which provides much of the water supply for Glasgow. The water supply is supplemented by two feeder lochs, Loch Arklet which is located within the lease area and Loch Finglas which is not. For water supply purposes, the water quality is high, which also benefits a range of other species and fisheries. The catchment is sited in a region of high rainfall, which is expected to increase as a result of climate change. Average rainfall using SAAR figures is given as 2232mm per year for Loch Katrine and 2361mm for Loch Arklet, with approximately 70% falling in the winter months of October to April. Current landcover, excluding the water consists of approximately 6% woodland, 67% heather moorland and peatland, and 27% grass. Proposals are to expand woodland cover to about 31% of the catchment area.

4.1.1 Evaluation

a) Water yield impacts

The present estimated annual hydrological yields and uncertainty limits associated with these estimates (based on the weighted averages of 4 evaluation methods) are 1819 ± 185 mm for Loch Katrine and 1963 ± 185 mm for Loch Arklet, with the inter-annual variation, (due to natural variation in the climate) amounting to 292mm and 307mm respectively. An increase in tree cover could potentially impact on water supply, as trees are generally more efficient than hill pasture at both intercepting water from the atmosphere and removing water from the soil through evapotranspiration.

A hydrological study undertaken to assess the impact of land use change in the catchment, estimated that for an increase in woodland cover from the present 5% to 66%, the impact on annual water yield would be equivalent to a loss of 3% of the current yield (or in other terms, equivalent to a reduction in precipitation of 57mm). Over the year the impacts would be greater in summer, as there is less rainfall at this time, although this loss is largely offset by an estimated slight increase in yield during winter months. Even taking into account possible sensitivity of the results,

which suggested a maximum loss of water yield in the summer of 21% (equivalent to -123mm precipitation), all of the modelled changes are less significant than both the uncertainty limits assigned to the original yield estimate, and the natural variation in yield due to climatic variation between years. These results suggest that even at a landcover of double the amount of woodland proposed, the impacts on yield are not sufficiently large to be easily measurable.

b) Water quality impacts

Water quality is currently high as measured by low nutrient status and low microbial loads. Quality can be affected by direct and indirect pollution by chemicals, by nutrient enrichment of water, possibly leading to algal blooms, and by sediment entering water courses or the loch.

In terms of the re-introduction of grazing, main issues will be the overall number of animals proposed, the location of handling facilities and disposal of any concentrated effluent arising; access to water supplies on lower ground and vehicle use, including refuelling and maintenance. It is not required that these issues are dealt with specifically in the ES, and also at this stage grazing proposals are only at an outline stage. These issues will only be covered in a general manner. Potential impacts of the proposed works on water quality relate to:

- The potential for chemicals, oils and fuel oil used in various woodland operations or vehicles employed for grazing management to enter the water supply directly through spills and leaks, or indirectly through accumulation in run-off reaching watercourses. Operations of concern include all groundworks using machinery, materials layout by ATV, harvesting, weeding and control of bracken and non-native species.
- The potential for chemicals, or animal effluent to enter the water supply and cause eutrophication. Operations of concern include fertiliser use and potential run-off from animal handling facilities.
- Land management practices which may result in modification of the drainage pattern, erosion, or increased sediments entering water. This can adversely affect fisheries as well as the quality of the water supply. Operations of concern include harvesting work, ground preparation and path and road construction. Locally, watering of livestock may also have impacts.

4.1.2 Mitigation

For all of these activities, relevant guidelines will be followed as covered in section 3.6. and both general and specific mitigation measures will be applied to minimise potential adverse impacts.

a) Use of chemicals and prevention of accidental contamination:

- A site plan will be prepared for all operations, detailing constraints and special working practices and liaison undertaken with relevant parties in advance of works being undertaken
- All fuel, oils, lubricants and chemicals will be stored safely outside buffer areas in designated locations and spillages will be guarded against using bunded tanks and transfer hoses and funnels for pouring, with mats used to absorb minor spillages
- Refuelling operations and maintenance of machinery will be undertaken outside buffer areas and away from bridges and culverts at designated locations.
- For herbicides, FC Field Book 8 *The Use of herbicides in the Forest* will be used when planning vegetation control and only pesticide or adjuvants with specific approval used near water. Mixture B will not be used within the SSSI area. All operations will be carried out in strict accordance with the Forestry Commission's Forest and Water Guidelines (4th Edition)
- Label advice will be followed at all times. Herbicides will be mixed and applied under the control of a certified person and correct spray dosage rates used. Herbicides will not be applied in inappropriate weather conditions.
- No chemicals will be applied over water courses and there will be no application of herbicides within 10m of streams or 20m of lochs and reservoirs, except when the product label allows its use in this situation.
- Waste containers will be removed from site and disposed of safely via an approved contractor. They will not be washed out near watercourses of any size
- Contingency plans will be prepared to deal with accidental spillage, operators will be familiar with plans and have materials to contain and absorb spillages on hand. Contingency plans will contain notification procedures for SW and SEPA, in the event of accidental spillages.

b) Use of fertilizers and prevention of chemicals leaching into the water supply:

- A site plan will be prepared for all operations, detailing constraints and special working practices and liaison undertaken with relevant parties in advance of works being undertaken
- Materials will be laid out to coincide with planting time and bags and excess fertilizer removed if not needed
- Fertilizer will be applied post planting by hand to a 1m² area around individual trees at a rate of 40g/trees for granular phosphate and 65g/tree for PK.

- No chemicals will be applied over water courses and there will be no application of herbicides within 10m of streams or 20m of lochs and reservoirs, except when the product label allows it use in this situation.
- Waste containers will be removed from site and disposed of safely via an approved contractor. They will not be washed out near watercourses of any size
- Contingency plans will be prepared to deal with accidental spillage, operators will be familiar with plans and have materials to contain and absorb spillages on hand. Contingency plans will contain notification procedures for SW and SEPA, in the event of accidental spillages.

c) Measures to minimise erosion, negative impacts on drainage and sediment entering water courses

- A site plan will be prepared for all operations, detailing constraints and special working practices and liaison undertaken with relevant parties in advance of works being undertaken.
- Ground preparation will be by hand or by excavator moulder, using discontinuous methods and ditch dolloping. Where ditches or drains are dug, they will end short of natural channels, ephemeral streams or old ditches .
- Buffer areas will be maintained, with no cultivation undertaken within 20m of burns over 2m in width, 10m for burns between 1 and 2m in width, and 5m for burns less than 1m.
- Travel through wet areas will be minimised and machine routes chosen to avoid water crossings wherever possible. Where such crossings are unavoidable appropriate measures will be taken to protect or minimise damage at crossing points.
- When harvesting is undertaken, trees will be felled away from streams and branches and tops kept out of watercourses.
- Heavily used access points and soils will be protected by brush, logs or stone and extraction routes will be chosen to minimise stream crossings. Where these are unavoidable, suitable measures will be taken to minimise damage, with pipes or log bridges used where required.
- Extraction routes will be minimised on steep ground, and offlets used to divert water from routes where necessary. Where cable crane extraction is used, the formation of worn trails will be avoided.
- Brush and timber stacking areas will avoid wet ground and buffer areas and bunding will be used where sediment run-off is likely to occur.
- For road and path construction routes will, as far as possible, wet areas and seepage routes will be avoided. Larger water courses will be bridged and where culverts and drains are used, care will be taken to avoid adverse impacts as a result of their installation. Catchpits and filters will be provided

in and adjacent to the drains to avoid pollution and sedimentation of watercourses and during bedding and pipe laying.

- Where culverts crossing watercourses shown on 1:50,000 OS maps, culverts will be agreed with SEPA under CAR regulations.
- Local watercourses will be inspected regularly for evidence of sediment inputs and remedial action taken, if discovered.

d) Grazing operations

- Water quality issues will take priority over any grazing proposals
- Only very extensive grazing regimes are proposed and livestock numbers will be extremely small compared to those previously present on the area
- Water quality issues will be paramount when identifying the location of handling facilities and disposing of any waste arising from them
- Livestock will be watered in a manner that is not detrimental to watercourses or to the overall water quality.

4.1.3 Issues raised during scoping meeting

Issue/ Subject	Potential Impact	Mitigation measures	Nature of Residual Impact
Increased tree cover within water supply catchment	Reduction in rate/total amount of water entering the supply system	Tree cover to be native broadleaved – impacts are less than conifer and hydrological assessment has been undertaken	Not found to be significant
Harvesting, ground preparation or road/path construction operations especially those requiring crossing of water courses	Increased run-off, erosion and sedimentation and resultant reduction in water quality and/or detrimental impact on fisheries	Forest and Water Guidelines Edition 4 to be followed as a minimum; Liaison with SEPA to be undertaken at planning stage of all works and authorisation obtained where required under CAR regulations; Water crossings to be minimised and FCS to assess all water crossings at planning stage to identify necessary protection measures. Discontinuous methods of ground preparation to be used, with any ditches ending short of ephemeral or permanent drainage channels; Buffer areas to be observed along watercourses which will be kept clear of branches, debris and	Some local negative impacts unavoidable, especially during periods of high rainfall, but should not affect loch water quality

Issue/ Subject	Potential Impact	Mitigation measures	Nature of Residual Impact
		brash; Harvesting to be undertaken in driest seasons where possible and build up of surface run-off prevented on extraction tracks with bunding of stacking areas if sediment run-off becomes a risk during high rainfall. For road construction, catchpits, and filters will be provided to prevent sediment entering water courses. Local watercourses to be inspected for evidence of sediment inputs and remedial action taken if found.	
Harvesting, groundworks or road/path construction operations ; layout using ATV, weeding and vegetation control operations	Chemical, fuel or oil spillages leading to contamination of the water supply and/or detrimental impact on fisheries;	Forest and Water Guidance Edition 4 to be followed as a minimum; Site plans will detail constraints, working practices and buffer areas to be maintained along watercourses; Storage, filling or fuelling operations to be undertaken at safe locations; Operators to be familiar with spills contingency plans and have materials to hand to contain or soak up spills; reporting mechanisms to be put in place to alert both SW and SEPA to any incidents.	The risk associated with the potential impact have been minimised as far as possible.
Use of chemicals	Contamination of water supply through spillages or run-off or leaching of chemicals into watercourses and lochs	Forest and Water Guidance Edition 4 to be followed as a minimum; Buffer areas to be maintained along watercourses; handling and application of herbicides to follow labels and guidance, with no storage, filling or washing of containers within buffer areas. Chemical use to be limited to Glyphosate, Propyzamide and Asulox. Operators to be familiar with accident contingency plans and have materials to hand to contain or soak up spills; reporting mechanisms to be put in place to alert both SW and SEPA to any incidents	The risk associated with the potential impact have been minimised as far as possible.
Use of fertilizers	Nutrient enrichment and contamination of water supply or detrimental impact on fisheries	Forest and Water Guidance Edition 4 to be followed as a minimum. Site plans to detail constraints, working practices and buffer areas. Fertilizer will only be used where required and applied by hand in the form of granular or ground rock phosphite or PK as	The risk associated with the potential impact have been

Issue/ Subject	Potential Impact	Mitigation measures	Nature of Residual Impact
		0:20:20 fertilizer. It will be applied to a 1m diameter area around trees, post planting. All bags and containers will be removed from site after use.	minimised as far as possible.
Fire	Adverse impacts to water quality as a result of fire fighting	All possible measures will be taken to reduce the hazard in periods of high risk. In the event of fire, no foam will be used as a suppressant within the catchment and Loch Katrine is to be used as a source of water in the last resort.	Impossible to avoid negative impacts if this occurs; risks minimised

4.2 Landscape

In order to retain the integrity of the different The Landscape Character Types described in section 12.16, constraints and opportunities for woodland expansion, access and other developments have been identified for each LCT. These have been taken into account in all proposals for the site and are summarised in the table below.

Table 10: LCT constraints and opportunities and relationship to work proposals

LCT Opportunities and constraints

Open Hills (Upper slopes, and summits around Loch Katrine)

Conserve and emphasise open, wild quality;
Use characteristic native species to soften transition between smooth and rugged ground;
Maintain visual dominance of dramatic landform and steep craggy slopes.

Wooded Hills (Maol Mor, Allt Glasahoile and Ben A'an)

Encourage natural regeneration;
Consolidate visual and ecological transition from wooded slopes to open hill;
Where woodland is expanded, conserve and enhance settings of historic features as part of a network of open space, reflecting the scale and integrity of past landuse.

Fit of Proposed Works with LCT

Planting only up to 340m; rocky outcrops left unplanted ; trees peter out towards upper margin – trees will not obscure tops or ridges .
Deer numbers maintained for grazing of heathland.

Expansion to be by natural regeneration only; historic sites will be protected by buffer zones; trees will naturally decrease in density at upper margins. Improve existing path within Ben A'an to provide access to adjacent areas.
Employ grazing to maintain open ground.

LCT Opportunities and constraints

Wooded Glensides (Wooded slopes around Loch Katrine)

Restore PAWS sites to native woodland; Consolidate visual and ecological transition from wooded slopes to open hills;

Expand native woods and forest habitat network;

Where woodland is expanded, conserve and enhance settings of historic features as part of a network of open space, reflecting the scale and integrity of past landuse.

Farmed Glensides (land around steadings at Glasahoile, Culigart, Edra and Letter)

Retain the visual and psychological diversity in the transition from human scale at lochside to wild expansive uplands;

Encourage continued farming where feasible and reverse neglect of pasture and buildings;

Where woodland is expanded, conserve and enhance settings of historic features and make this part of a network of open space, reflecting the scale and integrity of past landuse.

Freshwater Lochs (Loch Katrine)

Improve sensitive access to lochshore at appropriate locations without compromising tranquillity;

Retain and enhance the natural shoreline and the diversity in sequential views;

Avoid new buildings, structures and new leisure activities on the loch or shoreline; retain the present scale of settlements and roads.

Open Upland Glens (Glen Gyle, Allt a Choin valley, Strone valley)

Retain and enhance iconic views and ensure a visual and ecological balance between native woodland expansion and wider open space; Retain the wild character of upper slopes;

Expand isolated native woodlands with medium density woodland cover, with density decreasing towards upper margins and natural features left clear

Fit of Proposed Works with LCT

Primrose Hill, area to north of Ben A'an, Schoolhouse and Boathouse PAWS to be restored to native woodland and upper margins redesigned to show a natural transition to open upland above. Relict landuse patterns left intact, below woodland edges. Limited road developments to be undertaken to facilitate replacement of conifers with native woodland and PAWS restoration, with new paths for improved access by walkers. Employ grazing to maintain open ground.

Planting will be above relict landuse patterns at Edra and Letter, but will take in part of the area designated as medieval amalgamated fields. Planting here will only be at very low densities and field boundary features will be retained and protected by linear buffer zones. Limited new path development to allow access to hide for Black grouse observation. Employ grazing to maintain open ground.

Open areas will be retained along lochside, especially where important viewpoints occur. No new development, other than new laybys along shore road to facilitate timber extraction

The lower valley sides will be planted up to 210m (Strone and Glen Gyle), 320m for Allt a Choin Historic remains (groups of shieling huts) excluded from planting areas. And rock outcrops will be left clear of trees. Glen Gyle will be left largely open with smaller planting areas to frame

LCT Opportunities and constraints

of trees;
Natural regeneration to be managed to complement new planting proposals; Historic remains to be managed as an integral part of the open space network The glens allow views out of the enclosed landscape around the loch and. frame a number of classic views. Powerlines are prominent in views up Glen Gyle.

Farmed Upland Glens (Glen Arklet -north and south-west areas)

Enhance visual and ecological diversity of lower slopes;
Conserve and enhance settings of historic features as part of a network of open space, reflecting the scale and integrity of past landuse

Wooded Upland Glens (Glen Arklet south-east area)

Create more natural graded woodland to consolidate visual and ecological transition between woodland on lower hills and open upland areas; Where woodland is expanded, conserve and enhance settings of historic features and make this part of a network of open space, reflecting the scale and integrity of past landuse

Freshwater Upland Lochs (Loch Arklet)

Improve opportunities to access the loch shore and associated views for quiet recreation;
Improve loch setting with expansion of native woodland - ensuring the scale is in balance with the wider landscape and adds to visual and ecological diversity;
Where woodland is expanded, conserve and enhance settings of historic features and make this part of a network of open space, reflecting the scale and integrity of past landuse .
Avoid loch shore developments and those not in sympathy with current scale.

Fit of Proposed Works with LCT

views. Woodland will help to reduce prominence of powerlines
Employ grazing to retain open ground.

Planting boundaries kept above relict landuse areas and the Military Road. Creation of long distance path will ensure the road remains as a feature, with setting retained. Employ grazing to retain open ground.

Scattered woodland of very variable density here; naturally defined by soil types, with decreasing density. Oak only at lower margins. Employ grazing to retain open ground

Military road improves access and open new viewpoints at western end of loch; native woodland planting on north and south valley sides, leaving valley floor open

4.2.1 Evaluation

Potential landscape impacts of proposed works around Lochs Katrine and Arklet are critical because of the high number of visitors and the large number of potential viewpoints, both within and outside the catchment. This sensitivity is reflected by the number of Landscape Assessments undertaken and included in Appendix 11.

The evaluation therefore needs to take account of the initial and short term impacts relating to woodland establishment and access proposals – fencing, ground preparation, visibility of path lines and cut and fill operations on slopes; as well as the overall impacts of longer term changes in vegetation and woodland boundaries and the balance of woodland and open space. It also needs to address the impacts as experienced by users at different scales – including walkers or cyclists who pass through specific areas, visitors to the catchment who are interested in the landscape of the Loch Katrine area, and visitors to the National Park, who may not actually visit the site, but for whom Loch Katrine is seen as part of a much wider landscape.

During the establishment period, the main visual impacts arise from felling work, fencing, ground preparation and the changes in vegetation patterns as a result of fencing, new planted woodland areas will only become obvious after several years. Over the longer term, the design of new woodlands and fit in the landscape will be the main factor.

a) Felling work, and removal of non-native species

Close views: The most obvious work will be roadside felling at Schoolhouse and Boathouse, whilst felling on higher slopes will only be seen by users of new paths on Primrose Hill. Once trees are felled, landscape impacts tend to centre on presence of brash and other arisings.

Catchment and landscape scale views: Both within and from outside the wider catchment, felling impacts will be seen from distant views. In practice, although differences in vegetation patterns will be obvious until new planting becomes evident, impacts will generally be positive as the straight boundaries of conifer plantations are visually intrusive at present and tend to detract from the landscape.

Long term impacts: over time any negative impact will disappear as new woodlands develop and new boundaries more sympathetic to the landscape become visually dominant.

b) Fencing

Close views: In terms of walkers and cyclists, fences will inevitably be most obvious where they come into contact with roads and paths. Lower planting boundaries are generally set above the Shore road and are likely to be most visible for areas 25, 26, 31,32,33, and 34, where slopes are gentle, or boundaries close to the road. No new fences will cross the road, however the proposed new path descending from the west of Primrose Hill will pass through area 34, the track up

Glen Gyle through area 22 and the Military road through area 7. The Military road will also pass close to the lower boundaries of planting areas 1,19 and 17. In practice fences will have the most impact in the early years, until planting reaches head-height and this will be greatest for the smaller woodland blocks.

Catchment and landscape scale views: Poorly sited deer fencing may be more visible and will detract from an area which is valued for its qualities of naturalness and wildness. Except where they cross skylines, fences themselves are not highly visible; however differences in vegetation inside and outside fence are more obvious. The proposed fences will not cross skylines and local topography will be used to obscure or hide the line of proposed fences. Low density grazing by herbivores will reduce the impact of vegetation differences. Once woodland emerges, the landscape impact of fences is minimal, and once removed there will be no impact.

c) Ground preparation

Close views: In most cases, impacts are less obvious from close views and will only be evident to visitors who leave the Shore road and utilise forest tracks or the proposed new paths. Visibility will diminish gradually over a few years and there will be no long term impacts.

Catchment and landscape scale views: Impacts can arise due to the patterns that can result from soil disturbance, especially if these are regular. Over much of the planting areas, machine mounding will be used, with some hand and chemical screening on steeper slopes and measures will be taken to prevent extensive areas of parallel rows of mounds emerging. Although initially visible, once revegetated there will be no obvious impacts from ground preparation.

d) Road and pathworks:

Close views: The impact from paths is reduced through careful siting, whilst bare ground and disturbance of the natural vegetation on the verges or slopes above and below the path tend to have only short term impacts. Impacts of new roadworks and laybys are initially greater, due to scale, but similarly will decrease over time. Laybys will only be visible in close views.

Catchment and landscape scale views: From distant views paths and roads have the potential to be visible due to location on open slopes, alignment and scars created by cut and fill. In practice the amount of new road and paths proposed is relatively small and alignments have been carefully considered.

Only about half of the Schoolhouse path and of the new path to the west of Primrose Hill will be visible, potentially from viewpoints inside the catchment. Impact will diminish over longer distance views. Other path sections will be obscured by surrounding woodland. In the longer term, where good practice is used in siting and path construction, impacts tend to be minimal.

The landscape impact of the forest road extension is most noticeable from the southern shore and from Ben Venue. The visual impact, will however be limited. Whilst the first 60m section (18%) of the roadline can be seen, it is considered “visible but flat” as it is constructed on relatively level ground (up to 15%) with little batter. The second section (82% of the total road length) and the turning area is considered as being “screened by landform and standing trees”. This means that whilst the road corridor is likely to be visible from across the reservoir, the roadline and associated batter will not be seen. The precise location of the turning area will be determined at the time of construction, taking advantage of local topography to minimise the excavation required. The road will be more in evidence once adjacent conifers are felled, but by this time vegetation will have had time to recolonise. Once new broadleaved woodland is established, impacts will be minimal.

e) Woodland design

Close views: It is important to maintain the diversity of views, variety of experience and avoiding interruptions or dissonant changes in landscapes. Although the main aim is to create native woodland at a landscape scale, it is important that this does not lead to uniformity. Retention of areas of open ground within and between woodlands and the settings of groups and areas of trees within the local topography are important considerations, and flexibility is required at the time of planting to maximise opportunities.

Catchment and landscape scale views: At a landscape scale, the same factors are important, but the shapes, locations and cumulative impact of all woodland areas and the balance between woodland and open space, as well as their relationship to other landscape features and the different Landscape Character Types (LCT’s) becomes important. These are shown in detail on the Landscape Assessments in Appendix 11b.

4.2.2 Mitigation

a) Felling impacts

Felling impacts will generally be positive over time as plantation boundaries become blurred. Brash and lop and top will be visible initially, but much will be removed through use to protect soft ground and extraction routes. The remainder will break down over a few years, by which time vegetation changes will have more impact. Where large areas of rhododendron are cleared, close to roads and paths, arisings will be burnt.

b) Fencing impacts

Landscape impacts will be minimised by fencing of individual designed planting areas. This will prevent obvious horizontal banding of slopes due to differential development of vegetation, as fencing will follow the natural design of woodland edges. In general, fences will be set back from the shore road. Fences will also be

routed away from skylines and where possible, burnsidings and natural vegetation boundaries will be followed, as this will help to blend them into the landscape from long views. Where visible from the road or near viewpoints, fences will be hidden as far as possible, using breaks of slope and local topography. The lower boundary of area 21, although near to the road can be well hidden due to hummocky topography. Many of the lower planting edges in practice will coincide with hummocky or broken topography, or be invisible due to their location above near horizons, when viewed from the shore road. For walkers passing through new planting areas, fences will be more obvious until trees reach head height. Where paths run parallel to long runs of fencing, such as the Military Way through Glen Arklet, variation in line and ground conditions will be used to minimise visibility.

Redundant fences will be removed at the earliest opportunity. The fencing programme will also cover stock fences, which in some areas are in poor condition and detract from the landscape. Once grazing proposals have been finalised, these fences too will be rationalised and derelict fences will be removed where unnecessary, or replaced.

b) Ground preparation impacts

Ground preparation will be by excavator- mounding and will use three methods, inverted mounding, ditch-dolloping, and hinge mounding. Spacing will vary depending on the mounding system adopted for the soil and terrain conditions. . Retention of wetter areas and other open space within planting areas, as well as changes of slope and direction of travel will also create a varied pattern of mounds.

d) Access works impacts

New paths

Landscape impacts of paths will be minimised by using dead ground; varying curves and gradients to reflect the land; avoiding long straight parallel or horizontal alignments; avoiding crossing the faces of spurs and ridges; following existing vegetation boundaries to help hide the line; and where skylines are crossed, doing this at the lowest point. Path routes will be chosen where possible to avoid steep side slopes, where this is not possible, paths width will be reduced to avoid extensive cut and fill.

Most paths will be of 'as dug' construction, using local material won from cut and fill areas, any imported aggregate will be from local sources and in keeping with the site. Borrow pits will be filled and graded after use. Organic material, vegetation and topsoil will be stripped for re-use on verges and track edges to make these less visible. Side slopes above and below the path will be finished to a natural profile, and dressed using set aside topsoil and turfs to minimise visibility and speed up re-vegetation. Where rock is left exposed, cuttings will be irregular to mimic natural rock. Piped culverts will have stone headwalls to hide pipe ends.

Road extension and laybys

The landscape and visual impact will be reduced by careful consideration of the road alignment; use of local stone for surfacing; and ensuring the re-instatement of road batters. Early construction of the road extension will allow initial screening by adjacent conifers until vegetation has recovered and stabilisation of the re-instatement of road batters. Laybys will be constructed on flatter areas beside the road and using local topography where possible to reduce their footprint and visual impact.

e) Woodland design impacts

The majority of viewpoints are at distances where the new planting will be seen within the context of existing mosaic of forest, woodland and isolated groups of trees. The impact of the proposals will be high for a number of views in the short term - affecting 9 out of the 30 views assessed, of which 7 are primary views. Temporary deer fences will be most evident in close up views and is not likely to be obvious from the main viewpoints shown.

In the medium and long term visual impact over all is reduced to 'moderate' in 26 of the 30 views. Impact is 'low' in the remaining 4 views. (see Appendix 11a for a detailed assessment).

4.2.3 Issues raised during scoping meeting

Table 11: Landscape concerns raised at scoping meeting

Issue/Subject	Impact	Mitigation measures	Nature of Residual Impact
New planting Impact on landscape character and scenic quality of area	Quality and extent of specific, typical and iconic views	LCT opportunities and sensitivities have been taken into account in woodland design; Landscape Assessments of impacts of establishing and mature woodlands have been made from 22 main and 8 secondary viewpoints within and from vantage points around the areas to ensure woodland design will enhance views	Positive
Woodland expansion	Retention of mosaic of open and wooded ground characteristics	Network of open ground areas will be maintained along the lower loch shore, within planting areas and between lower and upper slopes, incorporating archaeological buffer areas. Regenerating woodland will be removed where impinging on important views and buffer areas. Re-	Positive

Issue/Subject	Impact	Mitigation measures	Nature of Residual Impact
		introduction of grazing will assist in management of open ground habitats	
Woodland expansion	Impact on wild remote open upland glen and upper slope landscapes, with respect to geomorphological features	LCT opportunities and sensitivities have been taken into account in woodland design; Woodland expansion is limited to lower upland slopes and up burnside; design will ensure a natural transition between wooded slopes and remote, wild uplands. Significant geomorphological features will be treated as constraints and will not be obscured by woodland planting	Positive
Woodland expansion	Retention of locally significant open ground and settings for natural and cultural features (burns, field patterns, old roadlines)	Sites identified and added to constraints maps. Relict landscapes will be retained as open ground, settings of groups of features have been respected. Construction of new path along historic road lines will retain road settings and ensure their continued preservation as historical monuments in the landscape. Interpretation will help develop awareness of historic and cultural context.	Positive for all post mediaval features. Medieval field boundaries will be retained, but part of area will be under low density trees.
Deer fencing	Landscape impacts	To minimise the impact of fences in the landscape, fences will be routed away from skylines, follow burns and natural vegetation boundaries and be hidden at breaks of slope and using other landscape features. Fences will be removed as soon as they have fulfilled their purpose.	Some local early negative impacts are anticipated, no long term impacts
Scale of proposals	Rationale for woodland expansion target	Aim is create a native woodland resource and initiate habitat network links within a 20 year timescale. Target realistic given landscape, cultural and physical constraints and available seed sources.	Positive
Paths and access routes	Visual impact	Routes, design and construction methods will minimise visibility	Positive

Issue/Subject	Impact	Mitigation measures	Nature of Residual Impact
		and landscape impacts	

4.3 Conservation - Habitats and communities

4.3.1 Evaluation

The Loch Katrine and Loch Arklet catchments contain a range of habitat types of conservation interest. 15 out of the 24 main plant communities found and all of the 4 woodland communities are included within the UK list of Priority habitats, which include threatened and nationally important habitats. The EU Habitats Directive 1992 requires member states to conserve important examples of upland habitats as Special Areas of Conservation (SAC). This legislation only applies directly to the Ben A'an and Brenachoile SSSI, which form part of the Trossachs Oakwoods SAC, however, 21 of the 28 vegetation types present are included in Annex 1 of this Directive, which provides an indication of their status. This list also includes 6 montane habitat types (U7,U10,U15,U16,U17 and M11) that are not included as UK Priority Habitats as generally in the UK they are not considered to be under threat, although U7,U10 and U17 are included in the Stirling LBAP for Montane Habitats.

Table 12: Conservation status of main habitats within the catchment*

UK BAP Priority Habitat	NVC communities present	Approx. surveyed extent ha	Comments
Blanket Bog /Mires	M15, M17, M18, M19, M25	3813	Included in Stirling LBAP Upland Mosaic Habitats and NP draft LBAP: Associated with priority species. Merlin, hen harrier, Skylark, Meadow pipit, Red grouse, Short-eared owl.
Upland heathlands	M15, H10, H12, H18, H21	510	Included in Stirling LBAP Upland Mosaic Habitats and NP draft LBAP: Associated with priority species: Skylark, Meadow pipit, Hen harrier, Merlin, Peregrine, Short-eared owl, Red grouse, Mountain hare.
Upland grassland (and Lowland dry acid grassland)	CG10, U4, U5	1025	Upland acid grassland included in Stirling LBAP Upland Mosaic Habitats. Generally one of most extensive habitats, but often of least value due to over grazing
Fen	M4, M10	476	Associated with priority species: Reed Bunting

UK BAP Priority Habitat	NVC communities present	Approx. surveyed extent ha	Comments
Upland Birchwoods	W4a, W4b, W17	61	Stirling LBAP
Upland Oak woodland	W11,W17	521	Stirling LBAP and NP draft LBAP. Associated with priority species: Pearl Bordered Fritillary, Pipistrelle bat, Bullfinch, Spotted Flycatcher, Black Grouse, Song Thrush, Red Squirrel
Wet Woodland	W4c, W7	22	Stirling LBAP and NP draft LBAP
Upland Mixed Ashwoods	W7c	1	Stirling LBAP and NP draft LBAP
Non UK BAP			
Montane and inland Rock	U7, U10,U17, H20,	12	Stirling LBAP (Local Priority Habitat not included in UKBAP) Associated with priority species: Golden Eagle, Mountain hare, Merlin, Peregrine

***Note:** the unsurveyed area of 2162ha includes upland heaths, grassland, blanket bog, montane vegetation and rock.

Of these, the vegetation types most likely to revert to woodland tend to be the least valuable in terms of general site biodiversity. They include areas currently under bracken, U20 *Pteridium-Gallium* community, U4 *Agrostis- Festuca-Galium* grassland, U5 *Nardus- Galium* grassland, M25 *Molinia- Potentilla* mire and M23 *Juncus- Galium* rush pasture. Many areas under bracken may have supported woodland in the past, whereas in the absence of grazing, dry heaths will naturally develop into upland oak and birch woodland types. U4 and U5 grassland areas without heavy grazing would revert to heathland and thence to woodland. M25 *Moilia –Potentilla* mire will generally succeed to scrub and wet woodland, where vegetation does not become too rank.

For natural regeneration, woodland expansion will naturally occur on the habitats described above. Of the areas identified for new planting, 29% of the land is currently under vegetation types described above. A further 31% is heathland, 31% classed as Blanket bog, 10% as grassland and 9% as fen. Areas of blanket bog, which coincide with planting areas 7, 8, 9 and 12 occur within mosaics of other soils and will be left unplanted.

4.3.2 Mitigation

It is not possible to mitigate directly against loss of habitat through conversion to woodland, and as most of the habitats in question are semi-natural and unimproved, they all have inherent value. However, where possible, the main habitats targeted

for woodland expansion are of the least value in terms of overall biodiversity. Also, the long term aim is also to replace these semi-natural habitats with new native woodlands and semi-natural woodlands which will be of conservation value in the future.

The remaining open ground habitats, particularly heathland and blanket bog, will benefit from the reduction in deer densities necessary to achieve regeneration targets. The control of grazing pressure will minimise the threat of over-grazing, whilst maintaining grazing at levels which should prevent vegetation becoming too rank. If a suitable balance can be maintained, this will improve the quality of remaining open ground habitats. Table 13 below highlights the threats facing the various habitats and impacts of proposals under the ES for woodland expansion, as well as mitigation measures to minimise adverse impacts.

Table 13: Main threats to habitats and impacts of proposals

Habitat	Main Threats to the habitat	Impacts of proposals/Mitigation	Overall impact
Blanket Bog and mire (M6, M17, M25, M23)	Heavy grazing, including deer; aerial application of chemicals, erosion through inappropriate recreation	31% of planting land is classed as bog and mire, however, woodland will not be expanded onto deep peat, and bogs and mires will generally be retained as open space within planting areas, with the exception of M25 Molinia – potentilla mire. Habitat losses will be minimal through planting, although there may be some drying out of transitional areas; Chemical application will be localised and by hand only, to minimise chemical drift and impacts on non-target vegetation; Areas of bog /mire will be avoided for groundworks, harvesting operations and paths: any negative impacts will be very local; control of grazing pressure through control of deer numbers should benefit the habitat	Positive overall, some localised unavoidable negative impacts
Upland heath (H10, H12, H21, M15)	Overgrazing, loss of dwarf shrubs Bracken encroachment	Loss of some habitat through planting as heathland accounts for around 31% of planting land . Various measures will assist in improving the remaining habitat- deer populations and grazing pressure will be controlled; bracken spread will be monitored and re-introduction of cattle may assist in	Negative through loss of habitat, but remaining habitat quality is expected to improve

Habitat	Main Threats to the habitat	Impacts of proposals/Mitigation	Overall impact
		reducing bracken spread.	
Upland grassland and Lowland dry acid grassland (U4, U5, CG10), Fen	Encroachment of scrub, bracken through inappropriate grazing	Shrub depleted grassy heathland U4 and U5 account for approx.10% of planting land. There will be some loss of habitat through woodland expansion; also reduction in overall grazing pressure and controlled grazing may assist in conversion of grassland back to heathland.	Negative through loss of habitat, but positive for biodiversity of site
Fen	Drainage, Scrub encroachment, succession to woodland	This accounts for 9% of planting land. Grazing pressure may help to inhibit loss of this habitat elsewhere	Negative through some loss of habitat
Upland Birchwoods	Clearance, lack of regeneration (over grazing)	Expansion by an estimated 566ha (natural regeneration)	Positive
Native Pinewoods	Lack of regeneration (age and grazing pressure) Fragmentation	Expansion of habitat by 328 ha No existing habitat to improve.	Positive (but limited as this is not a core area for this habitat)
Upland oakwoods	Overgrazing, invasion by rhododendron and other non-native species, unsympathetic management	Expansion of habitat by 208ha Removal of non-natives, management for regeneration and future supplementary planting of poorly represented species will improve structural and species diversity.	Positive
Upland ashwoods	Overgrazing, loss of structural diversity, invasion by non-native species (sycamore etc)	Expansion by 24ha Few sycamore in catchment – any spread will be monitored ; supplementary planting of under-represented species will improve diversity.	Positive
Wet woodland	Clearance, inappropriate grazing, invasive non-native species	Expansion by 160ha Supplementary planting of under-represented species will improve diversity. One of main new planting types.	Positive

4.3.3 Issues raised during scoping meeting

Table 14: Habitat conservation issues raised at Scoping Meeting

Issue/ Subject	Impact	Mitigation	Nature of Residual Impact
Woodland expansion within overall site context	Woodland expansion not sufficiently balanced with other interests on site	1970ha of woodland expansion amounts to the actual loss of some 1360 ha of open ground habitats, out of a total of 8220ha, once open space is taken into account. Much new planting will take place on habitats that are of the least value (areas dominated by bracken, grassland, Molinia mire or rush pasture. Priority habitats, mires and blanket bogs will be protected and remaining open ground habitats will be improved by the control of grazing pressure	Overall benefits to the site are positive
Woodland expansion	Protection of key habitats	Almost all land within the site is semi-natural and much of the area is included within a priority habitat type. Heathland, blanket bog and mires are some of the more important habitats in terms of dependent species and whilst some heathland and fen will be lost, the more important mire types will remain unplanted. Blanket bog is included on the constraints map and will be protected from damaging operations.	Generally positive for most priority habitats and those on which key species are dependant.
Woodland expansion	Impacts on species Schedule 8 (Wildlife & Countryside Act 1981	No plants or bryophytes/fungus of local or national significance have so far been recorded.	Not significant
Conifer felling and PAWS restoration	Damage to PAWS sites ground flora through belated or too rapid canopy removal	PAWS areas have been examined for ground flora interest. Areas with good ground flora will be retained and restored gradually to native woodland using selective and group felling over time to minimise impacts on ground flora. PAWS areas that are unstable or would become so if thinned, especially in proximity to roads, and areas with no remaining ground flora interest, due to prolonged shading, will be felled in phases and converted to native	Positive for highest quality areas; positive in long term for roadside areas currently lacking ground flora

Issue/ Subject	Impact	Mitigation	Nature of Residual Impact
		woodland using a combination of planting and natural regeneration.	
Woodland expansion	Loss of ancient Wood pasture through inclusion within new woodlands	Existing areas will be retained and control of grazing may assist in the regeneration of moribund areas. Use of cattle on site will mimic some of the processes that led to the establishment of wood pasture, although a more dynamic system will be introduced – with less human intervention	Positive
Reintroduction of livestock	Potential impacts on biodiversity	Livestock grazing will be undertaken to achieve biodiversity objectives and stocking densities controlled to avoid overgrazing.	Positive

4.4 Conservation – Birds

4.4.1 Evaluation

A total of 67 species of birds have been listed for the site, most identified during the 2006 Moorland Bird Survey. The majority of species (37) are dependent on a landscape containing some form of woodland, either as dense cover, open woodland, scrub, scattered trees or as woodland in a mosaic with open ground. A large number of these species (37) are included on lists or registers indicating some level of conservation concern. These include Annex 1 of the EU Birds Directive, Schedule 1 of the Wildlife and Countryside Act 1981, inclusion on BTO red and amber lists, or listing as a priority species under the UK, or local BAPs. These are listed on the table below together with a summary of the likely impacts of woodland expansion and new access.

Table 15: Conservation status of birds found in the catchment and impacts of proposals

Species	EU Birds Dir.	W&C Act 1981	BTO	UK BAP	LBAP	Likely impact of woodland expansion and pathworks
Black Grouse	*		Red	*	NP draft	Positive long term - increase in habitat, Possibly negative in short term due to possible fence strikes and disturbance.
Bullfinch				*	NP draft	Positive- increase in habitat
Buzzard			Red			Not likely to be affected – uses both treed habitats and more open in winter
Common Gull			Amber			Unaffected
Cuckoo			Amber			Positive- increase in habitat
Curlew	*		Amber			Impact probably limited –upland bogs unaffected
Goldcrest			Amber			Probably unaffected – increase in Scots pine as part of woodland habitat expansion
Golden Eagle	*	*	Amber		Stirling	Habitat changes not thought to be negative- positive long term as prey species increase
Grasshopper Warbler			Red			Positive – with increase in scrub habitat
Gray Wagtail			Amber			Impact probably limited

Hen Harrier	*	*	Red		Impact probably limited –can use woodland edges. possible increase in prey species
House Martin			Amber		Unaffected
Kestrel			Amber		Positive – increase in habitat
Lesser Redpoll			Amber		Positive- increase in habitat
Linnet			Red	*	Positive- where heathland/scrub habitat is improved/increased
Merlin	*	*	Amber		Negative- loss of habitat
Meadow Pipit			Amber		Negative – reduction in habitat
Mistle Thrush			Amber		Positive- increase in habitat
Osprey	*	*	Amber		Impact probably limited
Peregrine	*	*	Red		Impact probably limited
Raven				Stirling	Impact probably limited
Red Grouse			Amber		Unclear – habitat will be lost, but quality of remaining habitat may improve
Redstart			Amber		Positive- increase in habitat
Reed Bunting			Red	*	Impact possibly negative – reduction in fen habitat
Short-eared owl	*		Amber		Unknown - loss of habitat, but can use woodland edge and likely increase in prey species

Skylark	Red	*	NP draft	Negative – loss of habitat
Snipe	Amber			Impact probably limited
Song Thrush	Red	*	NP draft	Positive- increase in habitat
Sparrowhawk		*		Positive- increase in habitat
Spotted Flycatcher	Red	*		Positive- increase in habitat
Starling	Red			Impact probably limited
Stonechat	Amber			Negative- loss of grassy moorland
Swallow	Amber			Impact probably limited
Tree Pipit	Amber			Positive- increase in habitat
Treecreeper				Positive- increase in habitat
Willow Warbler	Amber			Positive- increase in habitat
Woodcock	Amber			Positive –increase in habitat

The number of listed species is indicative of the importance of the range and diversity of habitats occurring within the catchment. From these lists, it is possible to identify a number of species for which either UK/local concern exists, and also species which are of general concern throughout their range and could therefore be accorded a higher priority. The former include: Bullfinch, Linnet, Raven, Reed Bunting, Skylark, Song Thrush, Spotted Flycatcher, and the latter, Black Grouse and Golden Eagle. In addition there is third category of species of general concern (mainly raptors), that are not considered UK priority species. These include Hen Harrier, Merlin, Peregrine, Short-eared owl and Curlew. Impacts on these species are considered below.

a) General impacts for all species

Most bird activity was recorded in areas where a range of different habitats occurred in close proximity. Woodland expansion proposals aim to create woodland areas at a range of densities, interspersed with open ground habitats. Within woodland areas, native woodland planting will be at a range of densities and species will be chosen

to ensure good structural diversity within the resulting woodlands. Areas of wetland habitats, shallow soils around rock exposures, buffer areas around archaeological sites amounting to 30-50% (32% overall) of the area, will be retained as open space. These measures will ensure that a diverse range of habitats will be created, likely to be to the benefit of the majority of birds.

Provision of new access has been avoided in areas of interest for Golden eagles, but may cause some localised disturbance, especially to ground nesting birds. However, most paths are to be located within areas that are either already woodland, or will run close to new woodland edges. This is discussed further for individual species where impacts may occur.

b) Birds that may be negatively affected

The main species likely to experience loss of habitat through woodland expansion include **Hen Harrier, Merlin, Short-eared owl, Meadow Pipit and Skylark**. Impact on the three raptors in this list, as well as other raptors found on site, is however difficult to predict, as if there is a sustained improvement in the condition of the remaining heathland, together with an increase in woodland cover, prey species may become more abundant, which is likely to have a bigger impact on populations than habitat loss. Short-eared owl and Hen harrier will also hunt on woodland establishment and restock sites and forest edges of established woodlands. Meadow pipit made up the majority of records for open moorland, with frequent Skylark, so these species may be proportionately more affected. For **Reed bunting**, some impact may occur, as this species tends to occupy habitat both on the loch margins, but also close to some of the smaller tributaries on mid slopes. These wetter areas would, however, generally be left as open areas within new woodlands, but even if unplanted may be prone to scrub encroachment in the long term.

c) Birds likely to be positively affected or unaffected

The majority of species, including **Bullfinch, Linnet, Song Thrush, Spotted Flycatcher and Black Grouse** are expected to benefit from the increase in woodland area and greater habitat diversity created, whereas species such as Raven are not expected to experience significant impacts (most records of this species are above the upper planting limits).

d) Birds likely to experience specific impacts

Black grouse: Whilst this species is expected to benefit from the increase in habitat over the long term, Black grouse are also subject to short term potentially negative impacts. Deer fencing required to achieve woodland expansion at the proposed scale has been responsible for loss of birds through bird strike, which can have an impact where populations are low. Marking of fences has been shown to be effective in reducing risks of strike and the existing marked fence sections of the Primrose Hill deer fence, near to the Letter lek have no history of strikes. Current guidance suggests that all fences within a distance of 1.5km from established lek sites should be marked. Where fences are erected in the proximity of leks, they need

to avoid crossing flight lines into leks and be sited away from important feeding habitats (invertebrate rich damp areas with grasses, rushes, herbs and a shrubby ground cover of bog myrtle and ericaceous species).

The number of lek sites in the lease area has increased to seventeen over the years. Most of these are ephemeral, having been used in 2007 for the first time and involve single birds. The four established leks have or have had multiple birds and these as well as the lek at Loch Chon are within 1.5km of a new planting area. The sites with established leks have been assessed to consider the location of the fences. The Letter lek (east of area 34) will have fences to the east and west at approximately 225m and 75m respectively; Coille Mhor lek will have a fence 225m to the south; East Loch Arklet lek, fences at 425m to the north-east, 450m to the south-east and 625m to the south-west; The Loch Chon West lek will have fences to the north-north-west at 800m, the north-north-east at 1200m and the North-west at 1325m. The lek at Garrison on RSPB land is not affected by new planting within 1.5km.

Disturbance of leks is also a issue, particularly during the key lekking period of April and May and during nesting from mid April to mid August. Most females breed within 1km of lek sites and can be affected by disturbance from forestry and other operations, and also by people. Impacts of new access also need to be assessed. The proposed route to the east of Loch Arklet is around 500m from the lek, and due to the intervening road there will be little disturbance. The Black grouse lek at Letter is in closest proximity to new paths proposed at the western end of Primrose Hill (less than 200m distant). The topography is such that the lek site and path are not mutually visible and the periods of use by visitors are unlikely to coincide with use of the area by displaying birds, which is around dawn. Proposed new viewing access to the Culligart lek will be controlled to avoid disturbance.

Golden Eagle:

The impact of woodland expansion on Golden Eagle is directly related to the impact of the woodland on the abundance of prey. Closed canopy woodlands tend to reduce habitat available for hunting, whereas habitats with scattered trees, and particularly old trees, in association with open ground are favoured by eagles. Eagle ranges and breeding success are determined by available prey and carrion, with sheep and deer forming the bulk of carrion consumed (as well as occasional live prey) whilst grouse species and mountain hares are likely to be the most important prey species. The removal of the sheep from the area has not affected the breeding potential of the existing pairs, at the same time there has been a recovery of heathland habitat and this may lead to an increase in red grouse and mountain hare populations. General guidance for native woodland expansion within Golden eagle ranges is to create wide ecotones or transition areas between woodland and open moorland, with widely scattered trees (forming no more than 40% canopy cover at maturity). Where woodland expansion is planned good breeding and feeding habitats for prey species will be retained. These include open areas with ericaceous vegetation and cotton grass in wet flushes favoured by both mountain hare and grouse. Future maintenance of grazing pressure at levels that allow good heathland habitat to develop will also be important.

Disturbance is also an important factor for Golden Eagle and operations likely to cause this should be avoided within 750-1500m of nesting sites from mid March to mid August.

Species susceptible to disturbance:

In addition to impacts of habitat loss or change, most raptor species and some others are susceptible to disturbance of nesting sites, due to forestry or other operations. Where nesting sites are known or suspected, safe working distances and periods need to be adopted. Species affected include **Short-eared owl, Hen harrier, Osprey, Merlin, Peregrine and Gray Heron.**

4.4.2 Mitigation

a) Mitigation of impact of habitat changes

Whilst it is not possible to mitigate against loss of habitat for Hen Harrier, Merlin, Short-eared Owl, Meadow Pipit and Skylark, the proposed woodland expansion will affect approximately 1970ha (including internal open space) of open ground habitats, i.e. only 21% of the total area, with 65% of the catchment remaining as open ground. New woodland will also be sited to ensure connectivity between lowland and upland open ground habitats.

For raptor species, including Golden Eagle, a sustained reduction in grazing pressure is expected to lead to an improvement in the heathland habitat and potentially to the amount or prey species present. This would possibly compensate for the loss of carrion caused by the recent removal of sheep and help maintain the carrying capacity of the catchment. Where planting is proposed within known eagle ranges, areas are either relatively limited in extent, or very low density woodland is proposed, with an overall density of 200-300 trees/ha, providing a broad ecotone between woodland and open land, and in the long term future, possible new nesting areas. This is in line with guidance information on habitat preferences. Control of deer numbers will also benefit the heathland habitat of prey species. Grazing pressure does need to be maintained, and densities of deer likely to be beneficial for the habitat are similar to those required to achieve woodland regeneration.

b) Mitigation to avoid disturbance of breeding birds

For birds susceptible to disturbance, known or suspected nest sites will be recorded. If possible harvesting work will be undertaken to avoid the nesting season. Where this is unavoidable, areas will be checked for nests and mitigation measures applied. For all works likely to affect sensitive or rare species listed below, safe working distances will be applied, if work cannot be scheduled outside the breeding season.

Table 16 : Safe working guidance to avoid disturbance to breeding birds

Species	Habitat	Nesting period	Safe working distances during nesting season
Black grouse	Open ground, woodland edges	mid April- mid August	300-1000m
Golden eagle	Tree and cliff, Forest and open ground	mid march-mid August	750-1500m
Grey heron		February	200m
Hen harrier	Avoid disturbance of communal winter roosts	May-mid September	500-1000m
Merlin	Open ground, occasional forest edges	May - August	200-400m
Osprey	Tree nests	mid-April- mid August	350-1000m
Peregrine	Cliff nests in forests	May – mid August	600-1000m
Short-eared owl	Open ground, woodland edges	mid March-July	300-600m

c) Mitigation of impacts on Black grouse

To maximise opportunities for the species, areas of good feeding habitat will be avoided within woodland planting areas and where possible linked to other open ground habitats, with low density woodland planting on the margins. Control of foxes and corvids will be undertaken in the vicinity of leks from February to April to reduce predation of eggs and young.

To mitigate against the possibility of bird strike, any new fences established within 1.5km of an established Black Grouse lek, will be marked with droppers to increase visibility. This has proved effective in reducing the number of collisions elsewhere and droppers appear to be the most effective form of marking. Fences will be located to avoid crossing known flight lines. All fences will be walked at least once a year and monitored for collisions. If these occur, the situation will be assessed and further action taken. Monitoring of Black Grouse will continue and should any new leks be established, the need for fence marking will be reviewed. A programme of fence removal will be followed, with redundant fences removed as soon as new woodland areas become sufficiently established.

For work in the proximity of leks, where possible the breeding season will be avoided. If this is not feasible, the safe working distance guidance will be followed. For paths in proximity to leks, walkers will be encouraged to keep dogs on leads

and as part of the recreation plan, controlled access to lekking sites will be encouraged.

4.4.3 Issues raised during screening and scoping meetings

Table 17: Bird issues raised at Scoping meeting

Issue/ Subject	Impact	Mitigation	Nature of Residual Impact
Deer Fencing in proximity to Black grouse leks	Population impacts through bird strike	All fences within 1.5km of leks to be marked with droppers Fences will be located to avoid crossing known flight lines; fences to be monitored for bird strike and remedial action taken if required. Black Grouse monitoring to continue and additional sections of fence marked if new lek sites come into use. Deer fences to be removed as soon as practicable.	Long term impacts due to improved habitats are positive; potential for short term negative impacts still exist, but will be minimised
Impact of woodland expansion on golden eagles	Impacts on eagle ranges leading to reduced habitat suitability	Woodland expansion limited within areas known to be used by eagles; where trees are planted, they are to be established at very low density in line with habitat preferences. Golden Eagles will continue to be monitored.	Possibly positive in the long term as prey species increase
Woodland expansion	General impacts on other protected species , including those in Annex 1 of the Wildlife and Countryside Act 1981	Woodland expansion will lead to a loss of 2000ha of open habitats. This equivalent to 21% of the catchment area and much open habitat remains; planting has been designed to leave open space within planting areas as well as open ground between woodland areas; habitat diversity to be retained by leaving wetlands and areas near to rock exposures unplanted. Forestry and path construction operations to be times to minimise disturbance to sensitive/rare species. If undertaken during the breeding season, measures to be taken to protect nesting sites and safe working distances to be applied.	Positive for the majority of species including Bullfinch, Linnet, Song Thrush, Spotted Flycatcher and B. grouse; negative for Skylark, Meadow Pipit and possibly Reed bunting due to loss of habitat; unknown for Merlin, Hen Harrier and Short-eared owl, but impact probably limited by habitat changes, possible positive with increased prey species; probably little impact on raven.

4.5 Conservation – Fauna

4.5.1 Evaluation

Animals associated with the site include: Red and Roe deer, feral goats, badgers, otter, Red squirrel, Pine Marten, Pipistrelle, Daubentons, Natter and Long-eared bats, adders, Common lizard, Pearl Bordered Fritillary and Small Pearl Bordered Fritillary butterflies and the Small Chocolate Tip moth. Other species that might be expected to occur on site, but have not been recorded to date include Brown and Mountain hares and the Sable and Argent moth. The Stirling LBAP records water vole as being present in the south-east of the catchment, although there are no site records. The present information on animal species is patchy, but will be added to in time, through site monitoring.

Of the species mentioned, otters, red squirrel, pine marten, mountain hares, water voles, all bat species and adders are protected species under Schedule 5 of the Wildlife and Countryside Act, whilst Pearl Bordered Fritillary have partial protection. Red squirrels, otters, pipistrelle bats, mountain hares, water vole and the Pearl Bordered Fritillary butterfly are all identified as priority species in both the UK BAP and the Stirling LBAP, and Narrow Headed Wood Ants are also included in the UKBAP. For most species, protection and appropriate management of habitat is the best means of ensuring their protection and possible increase in populations.

a) Animals and insects associated with woodland habitats

Proposals to expand native woodland cover at a landscape scale, will benefit mobile mammals such as Pine marten and Red squirrel, although this may also allow Grey squirrel to colonise the area. In most situations this has led to the displacement of the native species. Possible factors cited include grey squirrel being at a competitive advantage in habitats dominated by large seeded broadleaves and susceptibility of Red squirrel to viral diseases. These factors are still not well understood and current advice to benefit Red squirrels is to limit the area of large seeded broadleaves, maintain conifer species of food value and to protect core red areas through buffer zones that are either treeless or consist entirely of spruce. Spruce is also used as a sporadic food source. The nearest core population is at Balquhiddy and North Achray.

Wood ants require relatively undisturbed woodland, with a diverse age and vegetation structure, and unshaded areas. They may spread locally within the SSSI if suitable management is undertaken, but are unlikely to be affected by woodland expansion proposals, except in the very long term. Pearl Bordered Fritillary butterflies (if present) also have specific requirements for scrub and bracken mosaics beside or within woods, with common dog violet as a food source. Grazing management with cattle may help create some of the required habitats and reduction

in heavy grazing may improve scrubby bog myrtle habitats favoured by Argent and Sable moths (if present).

b) Animals associated with riparian habitats and associated woodland

Proposals will have minimal impact on riparian habitats. The removal of conifers from riparian areas and use of best practice for planting proposals affecting these areas, will be generally beneficial for riparian habitats and wetlands. Species likely to benefit from the work include otters, which require clean water, good populations of prey species and good bankside habitats; Pipistrelle (and some other) bats, which rely on insect rich wetland and riparian habitats and old trees for roosting; and Water vole, which require undisturbed and stable banksides for burrows. Where conifers are currently shading watercourses, removal will generally be beneficial and proposals for woodland expansion aim to ensure that water courses and loch sides remain partially open, as well as the to protect key wetland habitats should prevent loss of habitat for these species and may, in the long term, increase the area of exploitable habitat available.

c) Animals associated with open ground

At present hares are noticeably absent from the species list. Maintained low density grazing of open ground areas should improve the quality and the amount of available habitat for these species.

4.5.2 Mitigation

Table 18: Proposal impacts and mitigation measures for protected animal species

Species	Potential Impacts	Mitigation	Residual Impacts
Red squirrel	Increase in native woodland habitat in long term, but loss of conifer habitat in short term through felling. Potential for displacement by grey squirrels in medium/long term	Relatively small percentage of large seeded species to be planted (20% oak); Remaining main food source stands of Norway Spruce, larch and Scots pine at the eastern end of Loch Katrine to be retained long term. New planting will establish a further 328ha of Scots Pine.	Probable limited impact in short term; positive in longer term as food sources increase unless grey squirrel become an issue
Wood ants	Woodland management	Nests will not be disturbed and any management work in the SSSI will take account of habitat requirements	None

Species	Potential Impacts	Mitigation	Residual Impacts
Pearl Bordered Fritillary (if present)	Lack of woodland management and loss of suitable habitat through colonisation by scrub and regeneration	Monitoring will help ascertain whether species is present; proposed grazing of site should help retain appropriate habitat and creation of open meadows; spraying of bracken avoided if dog violet present.	Positive
Argent and Sable (if present)	Loss of habitat through regeneration and over grazing	Wetland habitats are not candidates for woodland expansion, but may be subject to scrub encroachment over time, grazing will help retain habitats	Positive
Otter	Woodland expansion into riparian habitats;	Habitat: 50% of loch shore to remain open in potential regeneration areas and elsewhere open ground will be maintained along loch shores; water courses will be allowed to colonise naturally	Positive
Pipistrelle bat	Riparian and wetland habitats	Wetland and riparian habitats will be maintained; possible extension of habitats	Positive
Water vole (if present)	Disturbance	Wetland and riparian habitats will be maintained; possible extension of habitats	Positive
Mountain hare (if present)	Lack of good habitat	Grazing should lead to habitat improvement	Positive
Pine Marten	Woodland expansion and management	Monitoring will help ascertain distribution of already healthy population; increase in Scots Pine will be beneficial in long term	Positive in long term– increased habitat and prey species.

4.5.3 Issues raised during screening and scoping meetings

Table 19: Animal/insect conservation issues raised at Scoping meeting

Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Woodland expansion	Habitat changes for species included in Schedule 5 of the Wildlife and Countryside Act 1981	Conifers areas Retention of conifer areas providing seed sources for red squirrel will be retained and limited planting of large seeded broadleaves may limit colonisation by grey squirrels; measures taken to improve and retain good riparian habitats for otter, water vole and bats;	Positive or not significant for most species, positive in the long term for red squirrels, in absence of greys.
Disturbance by works	Impacts on species included in Schedule 5 of the Wildlife and Countryside Act 1981	Identified key species are added to constraint maps and appropriate measures taken to protect good habitats; felling sites and watercourses surveyed for key species prior to work being undertaken	Minimal impacts

4.6 Deer

Management of deer on site is key to achieving the woodland expansion targets and also to achieve conservation targets of reducing grazing densities to levels which allow the natural flora to thrive. Woodland expansion is to be achieved through a combination of planting and natural regeneration, with 40% of the area to be achieved through regeneration. This will require that tight control of deer densities is maintained. Perceived wisdom is that deer densities generally need to be reduced to around 5/ km², to prevent excessive browsing of regeneration. Culling of deer, however, has impacts on neighbouring landowners and specifically on neighbouring stalking estates to the north. Also for visitors to the site, the opportunity to view deer and other more elusive animals is an important consideration.

4.6.1 Evaluation

Deer numbers have increased substantially on the site since the removal of sheep in 2002. Animals are moving into the area from the north, and seasonally deer will move to the low ground around Loch Katrine during the winter months. At present two culling regimes are being implemented, with more stringent control in the south of the catchment, to protect investment in the adjacent FCS forest resource.

Despite an increase in culling levels, counts show that deer numbers have increased by more than three times between 2002/03 and the present and densities have risen from around 5/km² to the present level of around 13/km² in North Loch Katrine. A robust culling regime in the south of the area has consistently reduced red deer densities since 99/00 to the current level of 5/km². Average densities over the whole site are now 10/ km² and at present regeneration trial plots suggest that regeneration is taking place despite the relatively high deer density, but principally on the South Shore of the Loch. Impacts on other habitats will be determined once monitoring commences.

Future plans are to maintain populations at current levels, unless regeneration cannot be achieved, in which case a heavier culling regime will be undertaken over North Loch Katrine. To establish planted areas in the absence of deer fencing, however, would necessitate reducing densities to levels similar to, or lower than those maintained in South Loch Katrine over the whole catchment. This level of culling would have severe impacts on neighbouring landowners, as well as requiring deer stalking to be undertaken all year round, both in and out of season, which could adversely impact on tourism in the area. It would also impact on the levels of grazing the site is presently experiencing, which is considered to be light. Achieving woodland expansion through planting is not considered feasible in the absence of deer fencing, given the experience at Loch Ard and Loch Lomond where this approach has been undertaken over a number of years and where deer bowing of 90% is not uncommon even at low densities of 5/km².

The proposed fencing has been considered with due regard to the natural movement of deer. None of the fences are directly adjacent to public road and therefore deer will not be forced onto the road system, which might create a problem. All the proposed fences are enclosures, allowing the movement of deer along their natural corridors. At the same time this will ensure that access for hill walkers is unrestricted. Although the total estimated length of the fences is some 35kms, this is split into 35 separate planting blocks, located on the slopes around both lochs.

4.6.2 Mitigation

Fencing of planting areas will allow existing densities of deer to be maintained over the site and provide more scope for manipulation of grazing levels if required for biodiversity purposes. Fencing of individual blocks will also allow deer to follow usual seasonal movement patterns and allow more scope for out of season visitors to see deer. Compensation culls will be undertaken to ensure that carrying capacity is not exceeded through loss of winter grazing range.

4.6.3 Issues raised during the scoping meeting

Table 20: Deer issues raised at Scoping meeting

Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Deer fencing	Impacts on other species	See relevant sections	
Deer control	Impacts on overall deer populations and neighbours	Maintaining a two area culling policy and ensuring successful establishment by undertaking some of the woodland expansion within deer fences, also ensures deer are visible for visitors and minimises impacts on neighbouring stalking estates.	Positive

4.7 Archaeology

4.7.1 Evaluation

Within the catchment lease area, a total of 166 features or sites of archaeological interest have been identified to date. There are no sites of national or regional importance. However the sites identified, both individually and collectively provide a record of settlement and especially of the recent cultural history of the area and as such are of local significance. In this context, the setting of sites and features is important, as in providing a record of past landuse, there is often a relationship between several disparate types of remains. For example cultivation remains, enclosures, together with old banks or dykes and building remains provide evidence of how dwellings, land tenure and landuse were organised.

a) Survey sites

Most of the sites representing historic landuse patterns are located along the lower margins of the lochs or the foot of glens associated with the ancient woodland areas, which are also indicative of landuse in the 18th century. Lower planting boundaries have been moved upslope to exclude collections of sites and to maintain their settings. Many sites are located near to the Shore road, or proposed Military road path, providing good scope for interpretation. Remains of huts higher up slopes, or within the side valleys are either in locations where no new planting is proposed, or woodland boundaries have been altered to exclude groups of huts. The valley floor routes that would probably have been used to drive animals up to the higher grazing areas, have also been left unplanted, to strengthen this landuse connection. The few

remains that will be enclosed by woodland tend to be the footings of isolated huts on higher valley sides.

Within existing woodland areas are platforms and remains of charcoal working and on the lower margins of some woodlands, a few sites indicative of iron smelting. These sites will be monitored for scrub encroachment and periodically cleared of scrub/regeneration when other woodland work is undertaken in the vicinity.

Later structures identified are associated with the development of the area as a water supply and are mainly located around the loch margins. With the exception of several features along the line of the aqueduct route most remains are not directly affected by woodland expansion or access proposals.

As the main post-medieval settlements and associated field systems are excluded from planting areas, most sites have been protected. A total of 10 archaeological sites (mostly representing remains of a single feature) will fall within areas proposed for woodland planting, whilst a further 21 lie within potential regeneration areas. 30 additional sites, mainly groups of shieling huts, occur within the potential woodland expansion (PWE) area below 350m, but where there is no actual planting or regeneration proposed. In practice, woodland is unlikely to become established in these areas without intervention and remains here are at little risk.

b) HLUA

The nature and pattern of sites recorded during this survey confirm the local Historic Landuse Assessment model as published in a report on Loch Lomond and the Trossachs landscape character assessment. Historic land-use within the survey area falls broadly into two categories from the basis of known past land-use. These are Medieval to post-medieval holdings, agriculture and rough grazing whilst from the 18th century, areas of managed woodland increased, eventually reaching their modern extent. Many of the newly recorded sites reflect major changes that affected the area during the mid 18th century, when a large number of settlements were abandoned and the population dropped. Many of the deserted farmsteads recorded during this survey date from this period. There were also changes affecting those farmsteads that continued in use. With the abandonment of crofts based largely on cattle herding and transition to sheep herding on the upper pastures, many shieling-huts fell into ruins. The shelters, sheep-pens and other features still required by the shepherds appear to have been re-built as drystone structures, quite often on top of older shieling-huts using the readily available building material from the older ruins.

The relict patterns of settlements and agriculture exist at various locations around the loch. These include a few extensive and several smaller areas, some of which coincide with some of the planting areas. The main areas affected are the lower slopes which extend from the Strone burn in the west to the Letter burn in the east. The 2006 Headland survey identified a concentration of archaeological remains and enclosures reflecting the relict landscape at this location and the lower boundaries of planting areas 31,32, 33 and 34 were altered to reflect the findings. The northern

boundaries of planting areas 31,32 and 33 extend into the area assessed as having some medieval interest, with landscape and ornithological considerations also being important. A small area of relict landscape lies close to the edge of planting area number 12 to the south of Culligart, although no remains were found at this location. The Headland Survey may prove useful in refining and extending the HLUA relict settlement pattern, especially along the north shore of Loch Arklet and in Glen Gyle valley.

4.7.2 Mitigation

a) Areas affected by Woodland Expansion

Sites within proposed planting areas: Where archaeological features will be enclosed by planting areas, they will be marked in advance and protected by leaving an unplanted buffer zone of 20m around the site. Where two or more features occur in close proximity, they will be buffered as a group. For linear features, a variable buffer of 8-20m will be used to avoid wayleave effects that might have detrimental landscape impacts.

Sites within existing woodland, regeneration areas and areas of potential regeneration: These sites will be marked and monitored at 10 year intervals for encroaching tree/scrub cover. Using buffer zones as described for new planting, developing tree or scrub cover will be removed where it is encroaching on these zones.

HLUA Areas of interest: Lower planting boundaries have been amended to exclude relict land use patterns identified from survey findings. Very low density planting will take place in part of the area mapped as amalgamated medieval fields, but boundary features will be protected. Should any new sites be identified during works, they will be protected by use of appropriate buffer zones.

b) Sites located within areas where harvesting, ground and path works are proposed

Sites will be located and marked in advance of works being undertaken. During works, these sites will be avoided for working purposes, with trees felled away from these areas, wherever possible. Path lines, management and extraction routes will be chosen to avoid archaeological sites. In cases where contact with a site is unavoidable, all possible measures will be taken to protect remains e.g. use of brash mats, and the regional archaeologist will be consulted before work is undertaken. Any additional sites identified during work will be recorded and added to constraint maps. Appendices 9a,9b and 10 list NMRS, 1997 GUARD and 2006 Headland Survey sites respectively and Tables 21a and 21b below detail sites identified as occurring within original planting and regeneration areas and measures that have or will be taken to protect them.

Table 21a : Headland Sites Mitigation

Plant- ing area	Sites now excluded by amended boundaries	Sites within planting areas	Mitigation
1	151a-c, 152,153 (farmstead and buildings)	155 (shieling hut), 156 (drainage system)	Unplanted buffer of 20m around hut and drainage system to be left
7		143, 143f (18 th century road and associated quarry)	8-20m unplanted buffer to be left and edges scalloped to avoid a wayleave effect.
10/11	132 a-g (various waterworks features)		
17	160 (enclosure) 158b and 162 (groups of shieling huts)	161 a,b (2 shieling huts) 164 (isolated shieling hut)	20m unplanted area to be left around huts;161a,b will be buffered together
18/19	165a-f (enclosures, dyke bank, quarry); 171 (group of 4 shieling huts)		
19		135(shieling hut)	20m unplanted buffer is to be left
20	140c, 141a-c, 142 (enclosures, banks, rig and furrow and buildings)	172 (possible shieling hut)	20m unplanted buffer is to be left
20 WGS	173a-c (buildings)		
21	95	96 (dyke section)	Linear buffer 8-20m in width to be left
24		99 (stone and turf dyke)	Amend boundary to leave 10-20m unplanted buffer
26	100b,d,e,f,g,h (enclosure and other remains)	100a,c (dyke sections); 101a,b, (shieling huts)	Linear buffers of dyke sections 8-20m in width; 20m buffer around both huts
27		174d,e (dykes and sheepfold)	8-20m unplanted buffer to be left and edges scalloped to avoid a wayleave effect
28	176a,b (head dyke)		
30		109 (shieling hut)	20m unplanted buffer is to be left
32	119a-d (Field systems: and possibly linked existing dykes not included in survey)		
33	120 (enclosure with rig an furrow)		
34/35	123a,b,e,f,g,h,I,j,l,n		

Plant- ing area	Sites now excluded by amended boundaries	Sites within planting areas	Mitigation
	124a-j:(enclosures, banks, rig and furrow, buildings)		

Table 21b : GUARD sites Mitigation

Location and Features

Remains still in use:

Coilachra Wood: 44 (track)
 Schoolhouse Woods (east) : 64 (track)
 Glen Gyle: 41, (track), 42 (footbridge)
 Ben Venue: 77 (track/Right of Way)
 Military Road 1

Sites within existing woodlands:

Portnellan Woods: 10 (dyke)
 Coilachra Wood : 84 (furnace – not located)
 Primrose Hill Woods: 11 (dyke), 65 (dyke/track)
 Woods below Ben Venue: 74 (building/ enclosure)
 Glasahoile Woods: 33 (cairn), 34 (building/ rig and
 furrow)
 Culligart Woods: 29 (cairn/building), 28 (kiln), 23 (dyke)
 Royal Cottage Woods: 24 (quarry), 22 (shaft), 13-18, 20-
 21 (track sections, culverts and associated features), 19
 (dyke)

Sites within felling areas:

Schoolhouse felling area: 55 (dyke/possible enclosure),
 54 (cairn), 63 (enclosure and building), 53 (building)
 Primrose Hill felling area: 66(enclosure and building), 67
 (platform), 68 (cairn/platform).
 Felling area to north of Ben A’an: 69 (Cromwellian
 burial cairn)

Sites within conifer retention areas:

Schoolhouse Douglas Fir retention: 51 (schoolhouse
 founds), 52 (bridge)

Sites within SSSI woodland:

Brenachoile Woods: 70, 71 and 72 (dyke sections)
 Ben A’an Woods: 12 (limekiln), 79 (track), 76 (dam and
 furnace)

Sites within existing WGS planting areas:

Schoolhouse WGS: 81 (limekiln – not located)
 Stronachlachar WGS: 3 (enclosure- probably same as
 Headland site 142), 4 (enclosure and buildings), 10

Mitigation

Maintain lines of tracks clear
 for access;
 Military Road route to be
 upgraded if funding allows,
 as agreed with Stirling
 Council Archaeologist.

Monitor sites/features at 10
 year intervals for encroaching
 vegetation

Search for non-located sites if
 any work is undertaken in the
 vicinity.

Mark and ensure protection
 during harvesting operations.
 Ensure a 20m buffer area
 around the feature is kept free
 of regeneration or ground
 preparation operations and
 planting.

Monitor adjacent trees at 5
 year intervals; to avoid
 damage due to instability
 Ensure archaeological
 features are enhanced and
 protected, as per management
 plan.

Check for location of sites
 during ground preparation
 operations and planting; for
 all sites, ensure a 20m buffer

(bloomery – not located)

area around the feature is kept free of trees

Sites within regeneration areas:

Glengyle area: 8 (bloomery), 7 (mound).

Boathouse area: 9 (dyke), 58 (group of 6 buildings), 59 (dyke)

Portnellan area: 45 (buildings)

Schoolhouse: 47 and 48 (buildings), 49 (dyke and track), 56 (dyke and bank)

Wilderness area: 75 (building and dyke),

Culligart area: 27 (building/track)

Monitor regeneration and ensure a 20m buffer around the feature/group of features is kept free of regeneration

Other sites located within the 350m contour limit, but where regeneration is not intended:

Monitor at 10 year intervals for encroaching scrub/woodland

Schoolhouse area : 80 (dyke and drainage), 50 (enclosure and buildings)

Culligart area : 26 (building), 25 (shieling), 30 (building), 24 (quarry)

4.7.3 Issues raised during scoping meeting

Table 22: Archaeological issues raised during Scoping Meeting

Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Woodland expansion and setting of archaeological features	Potential damage to sites and loss of cohesion of the relict landscape, where features are obscured or isolated by intervening woodlands	Planting areas boundaries have been amended to exclude relict field patterns and associated remains of settlements. Woodland boundaries lie above main concentrations of remains. Sites enclosed by woodland will be buffered and if more than one site occurs, they will be buffered together. Features along loch shore will be retained within open ground. Other sites will be monitored for encroaching scrub/regeneration and buffer zones kept clear if this occurs. Opportunities will be taken to interpret some of the better preserved relict areas, where these coincide with paths	Positive – opportunities for increased understanding of the history of the area

Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Woodland expansion	Impact on HLUA due to woodland expansion proposals	Much of HLUA areas of interest are the existing woodlands – which will be protected and interpreted. Relict settlement patterns (as identified by remains) have been excluded from planting areas, and additional relict areas identified. The area around Edra, which is identified as medieval summer grazing will see limited planting. Any point or linear feature will be protected, with the proposed tree cover at very low density	Positive for post medieval remains; Medieval boundary features will be retained, with part of area under low density trees

4.8 Access and recreation

Whilst not directly required as part of the ES, some issues regarding access were raised at the Scoping meeting and are dealt with below. This section deals with the impact of proposals for the site on visitors and their experience of the area.

4.8.1 Evaluation

At present the main foci for visitors to the site are the recreational facilities provided at the Trossachs Pier and Stronachlachar. However a good proportion of visitors also come to walk or cycle in the area and at present almost all of this activity is concentrated on the Shore road. This leads to a certain amount of friction between walkers, cyclists and vehicular traffic all using what is essentially a single track road with passing places, especially at peak periods. Most use is concentrated to the north of Loch Katrine and recreational use of the generally bleaker area around Loch Arklet is restricted as there are few parking places along the narrow council road, which is used by fast-travelling coaches. The Shore road itself provides at least 30km of all-abilities access, but other than around Stronachlachar there is very limited scope to extend this, due to the terrain.

Despite the existence of a numerous published paths, asserted and proved Rights of Way around the catchment, only three path groups are actually used, and generally by hillwalkers. These include a secondary route to the top of Ben A'an, routes to access the summit of Ben Venue and two infrequently used hill routes to summits to north of Loch Arklet.

For visitors who seek shorter or less arduous routes and for family groups there is no specific provision apart from the Shore road. The only low level walking circuit

in the area originates outwith the site, in the Ben A'an car park.(passing through Craig Leven, but with no connections to the Trossachs Pier car park).

Access proposals are to create several new local paths to complete walking or cycling circuits at three locations around the north of the loch and at Stronachlachar, and to provide an off road route along the north shore of Loch Arklet with connections into several long distant routes and settlements around the Trossachs area. Proposed new paths routes have been designed to provide the type and length of walk for which visitor survey information identifies a demand, and have been devised using advice from local residents, businesses and community groups. They make full use of existing forest tracks, and with the exception of the Military Road, require relatively little new path construction to create several different circuits at three different locations around the more popular part of the loch. They also complement the Sir Walter Scott Trusts' plans to develop boat trips around the loch, using existing infrastructure of piers and jetties, with minimal development impacts on the lochshore. Path extensions to forest roads will be mainly as dug, using materials from site, and from 1.5-2.0m in width. Any imported material will be in keeping with the local landscape. The Military road will be a constructed path, 1.2-2.0m in width. Where footpaths need to pass through fenced planting areas, self-closing pedestrian gates will be erected.

The provision of new paths will enable visitors to enjoy a more varied experience of the area, provide a number of new options for walks, encourage visitors off the Shore road and provide panoramic landscape views from higher vantage points. Although the terrain prevents construction of all ability paths, the gradients will be such that they can be used by the majority of active visitors and also by family groups. The Military road and path to the west of Primrose Hill in particular, will provide good opportunities for the interpretation of features of geomorphological interest and of the historic landscape.

New paths at Primrose Hill and Stronachlachar are likely to be used most in the short term, as they are linked to car parks, jetties and other facilities. Schoolhouse will provide added interest to repeat visitors but popularity will increase if this becomes a drop off point for the shuttle boat and once new woodland planting becomes established. The feasibility study for the Military road, suggests it will be used by both local people and visitors once established. It is likely that use will increase over time, as the route becomes established.

4.8.2 Issues raised at the scoping meeting

Table 23: Access issues raised at the scoping meeting

Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Path construction	Location of paths and demand	Paths chosen to provide short local circuits of less than 2 miles, identified in Visitor Surveys as the preferred length of walk. Paths provide an alternative to the Shore road and high level viewpoints, not available from existing access. Paths at Primrose Hill and Stronachlachar are likely to be most popular in short term.,	Positive

5. SUMMARY STATEMENT OF THE SIGNIFICANT IMPACTS

5.1 Summary of Impacts and Mitigation Measures

The tables below summarise the main areas where environmental impacts of the project are of importance, mitigation measures that are proposed and the residual impact for each of the five identified issues (Public Water catchment, Landscape, Conservation, Deer and Archaeology).

PUBLIC WATER CATCHMENT			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Increased tree cover within water supply catchment	Reduction in rate/total amount of water entering the supply system	Yield impacts of native broadleaved woodland are less than conifer. A hydrological assessment of impacts of increasing tree cover by double the amount actually proposed in this ES, found that there would be no measurable impact on water yield.	Not found to be significant
Use of chemicals	Contamination of water supply through spillages or run-off or leaching of chemicals into watercourses and lochs	Forests & Water Guidance (Edition 4) to be followed as a minimum; Buffer areas to be maintained along watercourses; handling and application of herbicides to follow labels and guidance, with no storage, filling or washing of containers within buffer areas. Chemical use to be limited to Glyphosate, Propyzamide and Asulox. Operators to be familiar with accident contingency plans and have materials to hand to contain or soak up spills; reporting mechanisms to be put in place to alert both SW and SEPA to any incidents	Not significant
Use of fertilizers	Nutrient enrichment and contamination of water supply or detrimental impact on fisheries	Forest and Water Guidelines (Edition 4) to be followed as a minimum. Site plans to detail constraints, working practices and buffer areas. Fertilizer only to be used where required. Granular or ground rock phosphate or PK (0:20:20) to be applied by hand to individual trees, post planting.	Not significant

PUBLIC WATER CATCHMENT			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Grazing	Adverse impacts to water quality from enrichment or pollution	Low intensity grazing, with few animals. Any handling facilities to be built to approved standards and sited to prevent any slurry entering water courses; new filtration plant at Milngavie to be completed prior to any grazing being undertaken. Water quality monitoring will be undertaken.	No negative effects on water quality
Harvesting, ground preparation or road/path construction operations especially those requiring crossing of water courses	Increased run-off, erosion and sedimentation and resultant reduction in water quality and/or detrimental impact on fisheries	Forests & Water Guidelines (Edition 4) to be followed as a minimum; Liaison with SEPA to be undertaken at planning stage of all works and authorisation obtained where required under CAR regulations; Water crossings to be minimised and FCS to assess all water crossings at planning stage to identify necessary protection measures. Discontinuous methods of ground preparation to be used, with any ditches ending short of ephemeral or permanent drainage channels; Buffer areas to be observed along watercourses which will be kept clear of branches, debris and brash; Harvesting to be undertaken in driest seasons where possible and build up of surface run-off prevented on extraction tracks with bunding of stacking areas if sediment run-off becomes a risk during high rainfall . Local watercourses to be inspected for evidence of sediment inputs and remedial action taken if found.	Some local negative impacts unavoidable, especially during periods of high rainfall, but should not affect loch water quality

PUBLIC WATER CATCHMENT			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Harvesting, groundworks or road/path construction operations ; layout using ATV, weeding and vegetation control operations	Chemical, fuel or oil spillages leading to contamination of the water supply and/or detrimental impact on fisheries;	Forests & Water Guidelines (Edition 4) to be followed as a minimum; Site plans will detail constraints, working practices and buffer areas to be maintained along watercourses; Storage, filling or fuelling operations to be undertaken at safe locations; Operators to be familiar with spills contingency plans and have materials to hand to contain or soak up spills; reporting mechanisms to be put in place to alert both SW and SEPA to any incidents.	Some limited local impacts possible, but should not affect water quality
Fire	Adverse impacts to water quality as a result of fire fighting	All possible measures will be taken to reduce the hazard in periods of high risk. In the event of fire, no foam will be used as a suppressant within the catchment and Loch Katrine is to be used as a source of water in the last resort.	No negative effects arising solely as a result of ES proposals; fire hazard exists regardless of vegetation changes

LANDSCAPE			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
New planting Impact on landscape character and scenic quality of area	Quality and extent of specific, typical and iconic views	LCT opportunities and sensitivities have been taken into account in woodland design. Landscape Assessments of impacts of establishing and mature woodlands have been made from 22 main and 8 secondary viewpoints within the site and from vantage points around the area to ensure woodland design will enhance views	Positive

LANDSCAPE			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Woodland expansion	Retention of mosaic of open and wooded ground characteristics	Network of open ground areas will be maintained along the lower loch shore, within planting areas and between lower and upper slopes, incorporating archaeological buffer areas. Regenerating woodland will be removed where impinging on important views and buffer areas. Re-introduction of grazing will assist in management of open ground habitats	Positive
Woodland expansion	Impact on wild remote open upland glen and upper slope landscapes, with respect to geomorphological features	LCT opportunities and sensitivities have been taken into account in woodland design. Woodland expansion is limited to lower upland slopes and burn-sides; design will ensure a natural transition between wooded slopes and remote, wild uplands. Significant geomorphological features will be treated as constraints and will not be obscured by woodland planting	Positive
Woodland expansion	Retention of locally significant open ground and settings for natural and cultural features (burns, field patterns, old roadlines)	Sites identified and added to constraints maps. Relict landscapes will be retained as open ground and settings of groups of features have been respected. Construction of new path along historic road lines will retain road settings and ensure their continued preservation as historical monuments in the landscape. Features within woodland areas will be protected by unplanted buffer zones and regeneration encroaching within buffer areas will be removed. Interpretation will help develop awareness of historic and cultural context.	Positive

LANDSCAPE			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Deer fencing	Landscape impacts	To minimise the impact of fences in the landscape, fences will be routed away from skylines, follow burns and natural vegetation boundaries and be hidden at breaks of slope and using other landscape features and be set back from the Shore road. Redundant fences will be removed as soon as possible. Fencing of individual planting areas will prevent horizontal banding on slopes	Some initial local negative impacts are unavoidable., Longer term impacts are nil
Scale of proposals	Rationale for 2000 ha expansion target	Target realistic given aim of creating a native woodland resource with habitat network links within a 20 year timescale and existing landscape, cultural and physical constraints and available seed sources.	Positive
Paths and access routes	Visual impact	Routes, design and construction methods will use best practice to minimise visibility and landscape impacts. As dug methods will use local material to blend in. Routes will avoid long parallel allignments and use varied curves and gradients, following landform and natural boundaries where possible. Much of the new access is within woodland areas and will be hidden from long views. Skylines to be crossed at the lowest point, and steep side slopes avoided where possible to minimise cut and fill. Vegetation to be stripped and re-used on side slopes, which will be finished to a natural profile	Positive in the medium and long term, localised negative impacts initially.
Felling work	Visual impact	Felling will allow more natural woodland boundaries to develop in the medium and long term. Initially brash will be visible. Brash to be used where possible for ground protection. Rhododendron arisings close to roads/paths will be burnt.	Some vegetation impacts in short term. Medium and long term impacts positive

LANDSCAPE			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Ground preparation	Visual impact	Large areas of uniform mounds will be avoided by excavator mounding using discontinuous methods. Changes in direction of slope, travel and retention of buffer areas, wetlands and other open areas will minimise regular banding	Some impact in short term, medium and long term impacts nil

CONSERVATION- HABITATS			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Woodland expansion within overall site context	Loss or damage to non-woodland habitats	Almost all land within the site is semi-natural and much of the area is included within a priority habitat types. 2000ha of woodland expansion amounts to the actual loss of some 1000-1300 ha of open ground habitats, out of a total of some 8500ha, once open space is taken into account. Much new planting will take place on habitats that are of the least value. Priority habitats, mires and blanket bogs will be protected and remaining open ground habitats will be improved by the control of grazing pressure.	Positive at landscape scale
Woodland expansion	Habitat impacts on Blanket Bog and mire (M6, M17, M25, M23)	Woodland will not be expanded onto deep peat. Although 31% of planting land is classed as blanket bog, planting will be restricted to dry knolls and bogs and mires will generally be retained as open space within planting areas, with the exception of lower value M25 Molinia –potentilla mire. Habitat losses will be minimal through planting, although there may be some drying out of transitional areas; Chemical application will be localised and by hand only, to minimise chemical drift and impacts on non-target vegetation; Areas of bog /mire will be avoided for groundworks, harvesting operations and paths: any negative impacts will be very local; control of grazing pressure through control of deer numbers should benefit the habitat	Positive overall, some localised unavoidable negative impacts
Woodland expansion	Habitat impacts on Upland heath (H10, H12, H21, M15)	Some loss of habitat as 31% of planting land is heathland. Various measures will assist in improving the remaining habitat- deer populations and grazing pressure will be controlled; bracken spread will be monitored and re-introduction of cattle may assist in reducing bracken spread	Negative through loss of habitat, but remaining habitat quality is expected to be improved

CONSERVATION- HABITATS			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Woodland expansion	Upland grassland and Lowland dry acid grassland (U4, U5, CG10), Fen	Shrub depleted grassy heathland U4 and U5 account for 10% of planting land and fen for 9%. There will be some loss of habitat through woodland expansion; also reduction in overall grazing pressure and controlled grazing may assist in conversion of grassland back to heathland.	Negative, through loss of habitat, but positive for biodiversity of site.
Woodland expansion	Impacts on Species in Schedule 8 (Wildlife & Countryside Act 1981	No plants or bryophytes/fungus of local or national significance have so far been recorded.	Not significant
Conifer felling and restoration of PAWS sites	Damage to PAWS ground flora through belated or too rapid canopy removal	PAWS areas have been examined for ground flora interest. Areas with good ground flora will be retained and restored gradually to native woodland using selective and group felling over time to minimise impacts on ground flora. PAWS areas that are unstable or would become so if thinned, especially in proximity to roads, and areas with no remaining ground flora interest, due to prolonged shading, will be felled in phases and converted to native woodland using a combination of planting and natural regeneration.	Positive for remaining stable, highest quality areas, positive in very long term for areas of PAWS close to roads where no ground flora exists at present.
Woodland expansion	Loss of ancient wood pasture through Inclusion within new woodlands	Existing areas will be retained and control of grazing may assist in the regeneration of moribund areas. Grazing of cattle on site will mimic some of the processes that led to the establishment of wood pasture, although a more dynamic system will be introduced – with less human intervention	Positive
Reintroduction of livestock	Potential impacts on biodiversity	Livestock grazing will be undertaken to achieve biodiversity objectives and stocking densities controlled to avoid overgrazing.	Positive

CONSERVATION- BIRDS			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Woodland expansion and replacement of open ground habitats by woodland	Impacts on protected species , including those in Annex 1 of the Wildlife and Countryside Act 1981	14 species were identified as being of particular national or international importance, out of 34 listed species of concern. Woodland expansion will lead to a loss of approximately 1970ha (equivalent to 21% of the catchment area) of open ground habitats, but these will be replaced with a variety of woodland types and densities, associated with internal over 600ha of internal open space and unplanted wetlands and mires. Over 6240ha of open ground habitats will be retained, much contiguous with extensive areas of open ground in neighbouring ownerships, so fragmentation is not an issue. Five of the important species will directly benefit from habitat changes, three species will be affected by loss of habitat, whilst impacts on four others are more difficult to predict. Three species may not be significantly affected.	Positive for the majority of species including Bullfinch, Linnet, Song Thrush, Spotted Flycatcher and Black Grouse; negative for Skylark, Meadow Pipit and possibly Reed Bunting due to loss of habitat; unknown for Merlin, Hen Harrier and Short-eared owl, but impact probably limited due to habitat changes and possibly positive with increased prey species in long term; possibly positive with increased prey species in long term; possibly positive for Golden Eagle with increased prey species probably little impact on raven, curlew and peregrine.
Woodland expansion	Impacts on Golden eagle ranges and habitat suitability	Woodland expansion will be limited within areas known to be used by eagles; where trees are planted, they are to be established at very low density in line with known habitat preferences. Golden Eagles will continue to be monitored.	Unknown, but thought to be positive in the long term as prey species increase

CONSERVATION- BIRDS			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Deer fencing	Possible bird strike by Black Grouse	All fences within 1.5km of leks to be marked with droppers. Fences will be located to avoid crossing known flight lines; fences to be monitored for bird strike and remedial action taken if required. Black Grouse monitoring to continue and additional sections of fence will be marked if new lek sites come into use. Deer fences to be removed as soon as practicable.	Negative impacts may occur in early years, despite mitigation. Long term impacts due to improved habitats are positive
Disturbance due to forestry operations	Disturbance to breeding birds by noise and activity	Known raptor nesting sites will be recorded. Forestry and path construction operations to be times to minimise disturbance to sensitive/rare species. If undertaken during the breeding season, areas will be surveyed to assess presence of protected species and measures will be taken to protect nesting sites and apply safe working distances.	None
Disturbance by walkers	Disturbance to breeding birds, particularly ground nesting birds	Known raptor nesting sites will be recorded and where safe and feasible, walkers will be forewarned or directed away during sensitive periods. Most routes will not impinge closely on Black Grouse leks and lekking times tend not to coincide with periods of use. Concentration of access is to the north of Loch Katrine, away from the most established leks. Viewing access to Culligart lek will be controlled.	Low or not significant.

CONSERVATION- ANIMALS AND INSECTS			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Woodland expansion and habitat changes	Red squirrel	Remaining main food source stands of broadleaves trees and mature conifers (Norway Spruce, larch and Scots pine) at the eastern end of Loch Katrine to be retained; relatively small percentage of large seeded species (20% oak) to be planted and the overall species mix may limit colonisation by grey squirrels. Increased woodland cover by Scots pine, and general woodland expansion will improve red habitat in the future.	Positive in short term and longer term through habitat creation. Very long term depends on grey/red squirrel population dynamics and factors outwith the ES.

CONSERVATION- ANIMALS AND INSECTS			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Woodland expansion and habitat changes; Impacts on water quality	Otter	For water quality, the mitigation measures described in section 4.1 apply; Habitat: 50% of loch shore to remain open in potential regeneration areas and elsewhere open ground will be maintained along loch shores; water courses will be allowed to colonise naturally.	Positive
Woodland expansion and habitat changes	Pipistrelle bat	Wetland and riparian habitats providing main food sources and old trees (possible roost sites) will be maintained; possible extension of habitats	Positive
Woodland expansion and habitat changes	Water vole (if present)	Wetland and riparian habitats will be maintained; possible extension of habitats	Positive
Woodland expansion and habitat changes	Mountain hare (if present)	Grazing should lead to habitat improvement	Positive
Woodland expansion and habitat changes	Argent and Sable (if present)	Wetland habitats with Boog myrtle are not candidates for woodland expansion, but may be subject to scrub encroachment over time, grazing will help retain habitats	Unknown
Woodland expansion and habitat changes	Pearl Bordered Fritillary (if present)	Monitoring will help ascertain whether species is present; proposed grazing of site and woodland management for regeneration should help retain appropriate habitat; no spraying of bracken stands in or near to woodlands to be undertaken, if dog violet is present.	Positive
Woodland expansion and management	Wood Ants	Nests will be recorded and any management work in the SSSI will take account of habitat requirements. Nests will not be marked and will not be disturbed by works. Grazing and woodland mangament may expand	Positive

CONSERVATION- ANIMALS AND INSECTS			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
		suitable habitat.	
All works	Impacts of disturbance on Schedule 5 species of the Wildlife & Countryside Act 1981	Where possible, identified key species will be added to constraint maps and appropriate measures taken to protect good habitats; felling sites and watercourses will be surveyed for key species prior to work being undertaken to avoid disturbance.	None

DEER			
Issue/Subject	Impact	Mitigation	Nature of Residual impact
Deer fencing	Impacts on other species and landscape	See tables above	
Deer control	Impacts on overall deer populations and welfare	There is currently net migration into the area and grazing shortage is not an issue. Maintaining separate culling levels to the north and south of Loch Katrine, as well as undertaking some of the woodland expansion by planting within deer fences ensures successful establishment. Where areas are fenced, compensation culls will be undertaken. Acces to lower ground for winter grazing has been maintained.	Postive
Deer control	Impacts on neighbours	Maintaining a two area culling policy and undertaking some of the woodland expansion by planting within deer fences will ensure successful establishment and minimise the impacts on neighbouring stalking estates.	Negative, but minimised for stalking estates, positive for those with woodland expansion objectives
Deer control	Impacts on road users	Acces has been left to the lochside and fencing of individual planting areas will help avoid channelling deer onto roads at dangerous locations.	Positive

DEER			
Issue/Subject	Impact	Mitigation	Nature of Residual impact
Deer control	Impacts on visitors	Culling policy and intention to cull in season in North Loch Katrine will help to maintain deer populations on site for visitors to see and avoid disturbance to visitors during the main tourist season.	Positive
Deer control	Impacts on habitats	Open ground habitats will be monitored to ensue that control policy benefits the condition of key habitats.	Positive

ARCHAEOLOGY			
Issue/Subject	Impact	Mitigation	Nature of Residual Impact
Woodland expansion around archaeological features	Damage to features or loss within woodlands	The area of potential woodland expansion has been surveyed and all archeological remains recorded on constraints maps. Most features are excluded from planting areas. Remains that fall within planting boundaries will be protected by unplanted buffer zones extending to 20m for sites or 8-20m for linear features. Sites within woodland regeneration areas will be monitored for encroaching regeneration and buffer zones will be kept clear where this occurs.	Positive
Setting of archaeological features	Potential loss of cohesion of the relict landscape, where features are obscured or isolated by intervening woodlands	Planting areas boundaries have been amended to exclude relict field patterns and associated remains of settlements. Woodland boundaries lie above main concentrations of remains. Sites enclosed by woodland will be buffered and if more than one site occurs, they will be buffered together. Features along loch shore will be retained within open ground. Other sites will be monitored Opportunities will be taken to interpret some of the better preserved relict areas, where these coincide with roads and paths	Positive for post medieval remains

ARCHAEOLOGY			
Issue/ Subject	Impact	Mitigation	Nature of Residual Impact
Woodland expansion	Significance of the Historic Land Use will be lost	Much of HLUA areas of interest are the existing woodlands – which will be protected and interpreted. Relict settlement patterns (as identified by remains) have been excluded from planting areas, and additional relict areas identified through site surveys. The medieval field systems will be protected as much as possible. Much of HLUA areas of interest are the existing woodlands – which will be protected and interpreted. Relict settlement patterns (as identified by remains) have been excluded from planting areas, and additional relict areas identified through site surveys. Of the areas identified as medieval grazing only the boundaries remain. These will be protected and the proposed tree cover within these will be at very low density	Positive for post medieval remains;: Medieval boundary features will be retained, with part of area under low density trees
Felling, ground preparation and pathworks	Damage to archaeological features	Sites will be located and marked in advance of works being undertaken and avoided for working purposes wherever possible, with trees felled away from remains. Path lines, management and extraction routes will be chosen to avoid archaeological sites. In cases where contact with a site is unavoidable, all possible measures will be taken to protect remains e.g. use of brash mats, and the regional archaeologist will be consulted before work is undertaken on important sites. Any additional sites identified during work will be recorded and added to constraint maps	Positive

5.2 Discussion of Residual Impacts

Once mitigation measures have been implemented, the overall project impact will be as follows:

POSITIVE IMPACTS

- Conservation and management of both open ground habitats and woodlands
- Expansion and creation of new landscape scale native woodland habitats providing habitat links with native woodland to the east and west and developing the forest habitat network envisaged for the National Park.
- Improved access within the site for walkers, cyclists and family groups, to complement the all abilities access provided by the Shore road and provide alternative short routes which will open up new viewpoints at various locations around lochs Katrine and Arklet.
- The establishment of a new off-road route connecting the existing road around Loch Katrine to neighbouring settlements and tourist destinations, and providing linkages to long distance routes such as the West Highland Way, and forest road and access networks within Loch Ard Forest
- Potential for establishment of a through route from the slopes of Ben A'an to the east, connecting to forest road and access networks within the Queen Elizabeth Forest Park and Glen Finglas and NCR7
- Conservation and protection of important archaeological features and their settings, with improved access opportunities for the public providing new opportunities for interpretation and engagement with the cultural and historic past.
- Long term protection and stability of slopes within the public water catchment
- Positive contribution to key objectives of the Loch Lomond and Trossachs National Park Local Woodland and Forestry Framework strategy (2003) and other LL&TNP policies .
- The native woodland habitat creation will benefit and stabilise populations of most mammals present on the catchment.

NEGATIVE IMPACTS

- Sections of deer fences will be visible at some locations during early years of establishment and detract from the wild image of the area
- Limited sections of the pathworks may be visible in early years, until revegetation occurs
- Possibility of bird strike on deer fences
- Some bird species will be negatively affected through removal of open ground habitat
- Establishment works will be visually intrusive during early years
- Some disturbance to ground conditions and drainage by machines is inevitable during felling, ground preparation and path works

UNCERTAIN IMPACTS

- Long term impacts on some species such as Reed Bunting and some raptors are unknown, although not necessarily negative.

6. Annex to ES following Public Consultation

The tables below summarise the main areas where environmental impacts of the project caused concern for the consultees and the mitigation measures that are proposed for the five identified issues (Public Water catchment, Landscape, Conservation, Deer and Archaeology).

DEER			
Subject	Organisation	Issue	Forestry Commission Scotland Mitigation
Deer fencing	RSPB LL&TTNP	Section 3.5.16, Biodiversity monitoring (page 101) details that <i>'All deer fences will be walked at least once per year and bird strikes mapped. Results will be used to assess whether additional marking or early fence removal should be considered'</i> . Walking fence lines, at least once a year would not provide any meaningful results to inform a decision on whether additional action is required to combat strikes. I would recommend that all fence lines be walked once a month for at least the first 3 years.	Forest Research, the FCS research branch, has recently completed a formal project on deer fence monitoring in relation to marking and grouse collisions as part of the Capercaillie LIFE Project. This has improved our understanding of novel fence marking methods in terms of reducing black grouse collisions. In addition, we now have recent management experience of reducing grouse fence collisions in the Loch Katrine area and elsewhere. This accumulated knowledge and experience will be used as the basis for our fence positioning and marking work and we are satisfied that this will significantly reduce the threat of collisions. Given that all fences will be marked and positioned carefully, and given the low numbers of black grouse in the project area, we believe the extensive fence monitoring programme suggested cannot be justified because it would yield insufficient useful data. However, once the locations of the exclosures are finally determined, we will select some lengths of fence for

DEER			
Subject	Organisation	Issue	Forestry Commission Scotland Mitigation
			regular monitoring based on relative threat – with a view to further remedial action.
Deer fencing	RSPB	In section 4.4 Conservation – Birds, black grouse is recognised as a species likely to experience specific impacts and could be subject to short-term negative impacts. These negative impacts must be minimised as much as possible and the measures suggested should indeed do this. However, in the instance of the Letter lek, placing fences, which will be marked to the east and west of it at approximately 225m and 75m respectively, may still not be enough to prevent fence strikes. These fences would be classed as very high risk and consent should not be given for this element.	FCS will redesign the fencing in this area – and elsewhere as necessary – to ensure that fences are located as far as is practicably possible from existing leks. Fence lines will be chosen to minimise the risk of collisions. All fences will be marked.
Deer fencing	RSPB	There is no mitigation suggested for the loss of lek sites, which appear to be in a number of the new planting compartments. Could I suggest that in the mitigation for black grouse section (page 30) and/or in the planting proposals section 3.4.5 it should mention that particularly knolls with established leks will not be planted on and that the adjacent areas will remain open. These leks may need to be cut to keep the sward	FCS does not believe that availability of lek sites is a limiting factor. Established lek sites have been omitted from the establishment areas.

DEER			
Subject	Organisation	Issue	Forestry Commission Scotland Mitigation
		short and ideal for lekking.	
Deer fencing	RSPB	RSPB have concerns over the fencing proposals in this extremely important area for black grouse. As I mentioned earlier there are at least 41 lekking males in this area, which is a significant proportion of the Central Scotland black grouse population. In section 4.6, the impact prediction, assessment and mitigation of deer are discussed. We feel this section of the ES is lacking sufficient detail on the decision process that resulted in requiring or designing deer fences around each of the 35 new planting compartments. A full assessment of all the possible options for establishment should have been carried out and described in the ES, including a no fencing option, part fencing and various multiple compartment fencing options. FCS Guidance Note 11 Deer and Fencing, states it is FCS policy that the use of deer fencing would only be supported when no reasonable alternative is appropriate; the alternatives here need to be examined more fully.	<p>There will be fewer than 35 new exclosures, as we intend to merge some into bigger exclosures. This will mean less fencing in proportion to the planting area enclosed.</p> <p>As highlighted by the RSPB's former Black Grouse Project Officer (James Gordon), in his report to us in 2007, deer densities have increased following the removal of sheep and there is a significant problem of deer moving into the site from the different land ownerships to the north of the project area. We therefore believe that no reasonable alternative to deer fencing is appropriate. Appendix 1 details the information and decision process that resulted in FCS's decision to use deer fencing.</p>
Deer fencing	RSPB	If deer fencing is regarded as the only option	The Cowal & Trossachs District Conservation Manager

DEER			
Subject	Organisation	Issue	Forestry Commission Scotland Mitigation
		for establishing woodland, then a similar risk assessment as described in the Guidance Note for capercaillie must also be carried out for black grouse. Where this process identifies medium to very high-risk stretches of fencing, then these should not be permitted and must be redesigned either through marking and/or re-siting.	(Dave Anderson) and our national Species Ecologist (Kenny Kortland) will be directly involved in the positioning of all fences and shall undertake the risk assessments you describe on an ongoing basis. Appendix 2 outlines the planned black grouse mitigation and conservation measures for Loch Katrine project area.

CONSERVATION			
Subject	Organisation	Issue	Forestry Commission Scotland Mitigation
Paths	RSPB	In Table 8b, New Path Works on page 86, Culligart: all ability path to a black grouse viewing hide - this proposed new wildlife viewing facility mentioned in the ES should be explored more fully and discussed before identifying it in the ES. We believe the National Park LBAP Group would be a useful discussion forum for this project.	The path proposed for Culligart has been withdrawn in response to issues raised. The proposed DDA facility will now be incorporated into an existing new proposal at Primrose Hill. We shall discuss the wildlife viewing proposal with all relevant parties, including those on the National Park LBAP, but will include the proposal in the current plan.
Paths	SNH LL&TTNP MCoS	A proposed new footpath will pass through the Ben A'an section of the Ben A'an and Brenachoile SSSI. This site is also part of the	A general policy of open access will be encouraged across the catchment and responsible use of the area encouraged. Improvements to recreational facilities

CONSERVATION			
Subject	Organisation	Issue	Forestry Commission Scotland Mitigation
		<p>Trossachs Woods SAC for Western Acidic Oak Woodland. The site visit concluded that existing Victorian path alignments on the lower sections could be upgraded with minimal impact, but that in order to complete the new path, sections of entirely new path would also be required which would result in net loss of woodland habitat as well as minor changes to the distribution of habitat and probably disturbance of typical species.</p>	<p>proposed have been developed from information provided by consultees, communities and during the ICMP production. The proposals takes into account recent visitor survey information regarding likely increases in visitor numbers and the fact that the majority of visitors who have come to the area are likely to prefer short circuits or walks that can be enjoyed in conjunction with other visitor attractions around the loch.</p> <p>With regard to path through the Ben A'an SSSI, we have reconsidered the proposal and have decided to remove this element from the proposal, I have attached a map indicating the revised path network. The proposed DDA compliant path at Culligart has also been removed; this will now be incorporated into the existing Primrose hill path.</p> <p>A revised access to Ben A'an has been proposed, which remains outside the SSSI area and is within the boundary of the existing conifers. We have retained the Old Drove Road, which already exists through the SSSI within our plans, this would be upgraded with minimum impact, see revised Access map and Appendix 3.</p>
Paths	Community	In Table 8b, New Path Works on page 86, Culligart: all ability path to a black grouse	The path proposed for Culligart has been withdrawn in response to issues raised. The proposed DDA facility will

CONSERVATION			
Subject	Organisation	Issue	Forestry Commission Scotland Mitigation
		viewing hide - this proposal caused concern for the resident near to where the facility would be sited. Concerns raised about access along the single track road leading to the house.	now be incorporated into an existing new proposal at Primrose Hill.

LANDSCAPE			
Subject	Organisation	Issue	Forestry Commission Scotland Mitigation
Planting Densities	LL&TTNP	Mitigation of woodland design impacts appears to have only been considered at the landscape scale. It would be appropriate to include mitigation measures at a more local scale, particularly varying of planting densities to achieve more natural stocking densities and random planting patterns to avoid creating an artificial edges and lines.	The mitigation in the ES, tried to convey the design impacts of the woodland at local scale. Planting densities will vary across the site. Some areas will be planted at higher densities to allow the possibility of some future timber utilisation; for Scots pine densities of between 1600-2500 stems/ ha will be used, and between 1500-3000 stems/ ha for productive oakwood stands. The denser oak stands will be located on the better soils and more accessible areas along the north shore of Loch Katrine. The remainder of the woodland types will be established at approximately 1100stems /ha, with densities decreasing at altitude to mirror natural woodland development. In planting areas around Edra and Letter burns, lower densities of 200-500 stems /ha will be used, to reflect ornithological interests. Random planting patterns will be undertaken to avoid creating artificial edges, upper margins

LANDSCAPE			
Subject	Organisation	Issue	Forestry Commission Scotland Mitigation
			will be lower density to create a feathered edge.
Planted areas	Community	<p>Landscape</p> <p>The rugged moorland views from roads and properties are very highly valued and enjoyed by everyone and should be kept open to maintain the existing views of lochs and mountains. The planting schemes do seem to gradually obscure and change the grazed moorland feel of the area. If the existing in-by fields surrounding properties were agriculturally grazed/or cut to prevent the insurgence of dense birch scrub, some of the views would be preserved.</p> <p>Planting</p> <ul style="list-style-type: none"> • It would seem that the original plan for natural regeneration has been abandoned in favour of planting schemes. Concerns regarding these include: • Losing distant and open views from properties; often the reason that people moved into these houses in the first place and therefore of very high priority to them. 	<p>At a meeting on the 29th January FCS presented the planting proposals for the site. This proposal had been developed through consultation prior to the Environmental Impact Assessment, including the LKCT, to get a plan, which achieved the outcome we were asked to deliver.</p> <p>Forestry Commission Scotland were appointed lease holders when West of Scotland Water decided to concentrate on their core business and removed themselves from land management. To ensure the FCS delivered the required outcomes WoSW produced the Integrated Catchment Management Plan, this detailed the woodland, farming, conservation and recreation objectives demanded.</p> <p>The key woodland objectives were:</p> <ul style="list-style-type: none"> • Creation of a native woodland corridor from Glen Finglas to Loch Lomond. • Expansion of the existing native woodland area. <p>FCS agrees that we want to retain the rugged nature of the area, consequently the planting boundaries are kept well down the hills to ensure the views are maintained. When the landscape proposals were being developed we identified some 29 key view points around the catchment,</p>

LANDSCAPE			
Subject	Organisation	Issue	Forestry Commission Scotland Mitigation
		<ul style="list-style-type: none"> Fencing. Should all areas marked for planting be deer fenced then the whole area will be covered with unsightly deer fencing. This would also impede general access to the hills. 	<p>these have been maintained through the woodland delivery and if required these will be kept open either by cutting or grazing.</p> <p>The woodland development will be through a combination of planting and natural regeneration; the split is 58% and 42% respectively. The reason for planting is that we can develop different types of woodland, which would not be present if we relied on regeneration, these woodlands include Oak, Slope Alder, Ash and Scots pine. If we relied entirely on regeneration the only woodland likely to develop would be scrub Birch.</p> <p>By developing the suggested woodland types this in addition to creating a more natural landscape also improves the biodiversity of the area. With the increase in woodland will be an increase in the number and variety of flora and wildlife utilising the habitat. Not only will there be open moorland birds and wildlife there will also be woodland associated assemblages. This will help maintain some of the more iconic species present on the catchment.</p> <p>One of our primary objectives when considering the placement of woodlands is to create a Forest Habitat Corridor, this needs to be an almost continuous habitat. If the gap in the corridor is great, more than a few hundred</p>

LANDSCAPE			
Subject	Organisation	Issue	Forestry Commission Scotland Mitigation
			<p>metres small mammals and flora will be prevented from moving along the network.</p> <p>At the last meeting on the public meeting on the 4th August it was suggested that no planting was to take place on the Loch Arklet catchment, Forestry Commission Scotland cannot agree to this proposal. We are sympathetic to the communities concerns and have demonstrated the background to the proposed woodland establishment, including the benefits. However, in order to demonstrate we take on board the views of the community we have modified our plans. The area of woodland identified in the Environmental Statement for Loch Arklet area has been reduced by approximately 89ha. This has been achieved by reducing the sizes of the planted areas, which will increase the area of open space between the woodland areas.</p>
Military Road	Community	<p>Proposed linking of Stronachlachar to Inversnaid by 'Historic Route'</p> <p>There is strong local feeling generally against the use of the 'military road' as proposed. Whilst residents were aware of the feasibility study, there has been no official planning notification to properties involved. They are somewhat alarmed to find the path as a major</p>	<p>The proposed upgrade of the Military Road is a plan being led by the Stathard Community Trust Historic Path Group, FCS considers this to be viable way of removing pedestrians and cyclists from the Inversnaid road, consequently we have included it in the Environmental Statement.</p> <p>A feasibility study was undertaken in March 2005 to consider the implications of upgrading the route. During</p>

LANDSCAPE			
Subject	Organisation	Issue	Forestry Commission Scotland Mitigation
		<p>part of the LKEP. There are differences between the path marked on the feasibility study map and that in the LKEP, especially below Arklet Dam. The main objections and concerns are:-</p> <ul style="list-style-type: none"> • Loss of security, peace and privacy to properties close to the proposed route. • Open access to dam would encourage ad hoc car parking in order to have a ‘quick look’ over the dam by motorists. This would impact greatly on adjacent properties and create a potential hazard on the road. • Water supplies/pipe work being crossed by the track: Potential fouling of supplies and damage to pipes, etc. 	<p>this study consultation was undertaken and comments sought from Stathard Community Council and the Loch Katrine Community Trust amongst others. FCS has continued this consultation during the initial planning for the recreational proposals.</p> <p>Following the concerns raised by the community the Steering Committee from the path group met residents on the 25th January 2008 to discuss the issues raised.</p> <p>The result of this is that the path, which was to be routed over the dam, will as suggested continue passed the Loch Arklet houses and cross at the Bridge on the Arklet Water. Indicative approval from RSPB and Scottish Water for this change has been received. The line of the path at Corriarklet has also been moved back to the original proposal suggested at the time of the feasibility study.</p>

PUBLIC WATER SUPPLIES			
Subject	Organisation	Issue	Forestry Commission Scotland Mitigation
Paths	Community	In Table 8b, New Path Works on page 86, Culligart: all ability path to a black grouse viewing hide - this proposal caused concern for	The path proposed for Culligart has been withdrawn in response to issues raised. The proposed DDA facility will now be incorporated into an existing new proposal at

PUBLIC WATER SUPPLIES			
Subject	Organisation	Issue	Forestry Commission Scotland Mitigation
		the resident near to where the facility would be sited. Concerns raised about contamination of supply.	Primrose Hill.
Planted areas / Paths	Community	<ul style="list-style-type: none"> • Private water supplies: Often from small streams which, at certain times of the year, may dry up totally if the surrounding catchment is planted up. Worries re. damage to pipe work/tanks at planting stage and subsequent maintenance and cropping of trees and by tree roots. • Chemical run-off from fertilizers may get into the supplies (bracken control/planting). • Leaves and twigs may clog systems particularly in Autumn and Winter, bearing in mind the windy conditions prevailing in the area. • Drainage ditches which protect houses may get filled in and not be maintained, e.g. at properties below Arklet Dam. 	<p>The issues raised by the community were the risk to private water supplies from the woodland establishment work. FCS has a long history of dealing with these types of supplies throughout our existing estate in a very effective and successful manner. We can reassure residents that we will take every precaution to identify and protect these supplies during the woodland and path works. We have already met some of the residents at Loch Arklet to discuss their concerns and find solutions; this invitation will extend to all residents who request a visit.</p> <p>At the meeting of 29th January 2008 FCS indicated the need to reserve the right to use chemicals on the site, through good establishment practices it is assumed the use of these will reduced considerably. There is still the need to reduce the spread of bracken and it is hoped much of this will be achieved through trampling from grazing animals but if required we need the option to use chemical solutions.</p>

ARCHAEOLOGY			
Subject	Organisation	Issue	Forestry Commission Scotland Mitigation
Military Road	Stirling Council's Archaeology Officer (SCAO)	Site Description The assessment here that none of the sites recorded on the estate is of regional or national importance. There is no doubt that the Military Roads and any features associated with them, such as culverts and bridges, are certainly of regional significance. This should be recognised in the ES.	FCS recognises the Regional significance of the Military Road.
Relict landscape	SCAO	The use of phrases such as “relict landscape” and “relict field patterns” needs explanation somewhere in the Environmental Statement, even if it is only explained on first use of concept. It is liberally scattered throughout the ES e.g. 2.14.1 p 58 and 4.7.1 b) p 138. At Loch Katrine relict features are effectively surviving remnants in the landscape of a system of land-use which is no longer practised.	Description of the terms “relict landscape” and “relict field patterns”: ‘Some former land-uses are no longer used or maintained for their original purpose, but have nevertheless left traces which are still visible in the present landscape. These are known as 'relict' land-uses, settlements or landscapes. They reflect the survival of major national patterns of past land-use in the landscape, and are defined by their period of origin and by their form and function. In the Loch Katrine area these comprise remnants of pre-improvement agricultural systems of medieval/post medieval date, including deserted farmsteads and old field boundaries on some of the lower areas, and head dykes and groups of

ARCHAEOLOGY			
Subject	Organisation	Issue	Forestry Commission Scotland Mitigation
			shieling huts on the higher slopes and glens.’
Bracken	SCAO	Description of proposal The issue of bracken is raised here in relation to visual impact of obscuring archaeological sites. It should be noted that bracken rhizomes also have the potential to do damage to buried archaeological remains and this should also be mentioned here (HS research).	FCS recognises the issue of bracken in relation to archaeological sites, if this becomes a problem appropriate remedial action will be considered in discussion with SACO.
Planting	SCAO	Planting Within the new woodland areas open glades will be maintained for both ecological and visual reasons.” To this I would add archaeological/ cultural heritage reasons. This might allow more than a simple 20m buffer if larger open spaces could be justified on a variety of grounds eg Habitat Network Creation.	FCS has mitigated this issue during the preparation of the plan by leaving out archaeological features, as a minimum 20m buffers around features will maintained. If further opportunities are identified during the planting operation these will be explored.
Planting	SCAO	Protection of sites Details of any new sites new sites, which are identified will be added to the constraints map. They should also be reported to Stirling Council’s Archaeology Officer for incorporation in the Stirling and Clackmannanshire Sites and Monuments	FCS will report any new sites to the SACO for incorporation in the Stirling and Clackmannanshire Sites and Monuments Record.

ARCHAEOLOGY			
Subject	Organisation	Issue	Forestry Commission Scotland Mitigation
		Record.	
Planting	SCAO	<p>Protection of sites</p> <p>Sites located within areas designated as natural regeneration or planting areas, or potentially at risk within existing woodlands will be monitored at 10 yearly intervals, to check for encroaching vegetation and this will be removed if necessary. 10 years growth could cause substantial damage to archaeological remains both as it is growing and by its 'removal'. Is a 5-year interval more appropriate.</p>	<p>FCS has been studying the level of regeneration over the last 5 years and while we are seeing evidence of some recovery, the majority of regeneration is still not greater than 60cm tall. Given this evidence monitoring at 10 year intervals is a realistic timescale.</p>

Appendix 1

FCS rationale for the decision to use deer fencing

Background to Forestry commission Scotland's Deer Management policy

Forestry Commission Scotland's (FCS) involvement with deer management at Loch Katrine started approximately 2 years before the lease was finally signed with Scottish Water in 2005. This was at the time when the last of the sheep were being removed from the catchment and the expectation was that deer numbers would increase due to the lack of competition with sheep. Population counting started earlier in 2000 when the site was counted as part of a DCS audit. The outcomes following this audit and the current population and cull regimes will be discussed later in this Appendix.

The current deer management team working on the Loch Katrine project is led by Brian Kelly, Wildlife Ranger Manager, with strategic support provided by Colin Lavin, Deer Management Officer. There are currently two dedicated Wildlife Rangers in Loch Katrine, one operating on North Loch Katrine and the other in South Katrine and Arklet. Culls are challenging at approximately 150 and 120 respectively and are monitored annually based on the results of damage monitoring and population counts.

The deer management team have undertaken annual helicopter counts of the deer population in Loch Katrine and in certain years across the whole of the Balquidder Deer Management Group area. Frequent discussions have taken place with the Project Manager to ensure that a suitable protection regime is in place for the proposed new planting. The results of this have modified the areas identified for planting where this affects the natural movement of the deer population and the type of protection best suited to the woodland and biodiversity objectives. FCS is an active member of the local Balquidder Deer Management Group with discussions taking place with adjacent landowners, including the RSPB, on a frequent basis.

Population trends

Deer numbers have increased substantially on the site since the removal of sheep in 2002. Animals are moving into the area from the north, and seasonally deer will move to the low ground around Loch Katrine during the winter months. Despite an increase in culling levels, counts show that deer numbers have increased by more than three times between 2002/03 and the present and densities have risen from around 5/km² to the present level of around 13/km² in North Loch Katrine. A robust culling regime in the south of the area has consistently reduced red deer densities since 99/00 to the current level of 5/km². Average densities over the whole site are now 10/km² and at present regeneration trial plots suggest that regeneration is taking place despite the relatively high deer density, but principally on the South Shore of the Loch. Impacts on other habitats will be determined once

monitoring commences. The tree species being planted (Scots pine, oak, ash, alder and others), or regenerated, are all preferred browse species for deer and hence very vulnerable to damaging impacts

Future plans are to maintain populations at current levels, unless regeneration and other biodiversity objectives cannot be achieved, in which case a heavier culling regime will be undertaken over North Loch Katrine. To establish planted areas in the absence of deer fencing, however, would necessitate reducing densities to levels similar to, or lower than those maintained in South Loch Katrine over the whole catchment. This level of culling would have severe impacts on neighbouring landowners, as well as requiring deer stalking to be undertaken all year round, both in and out of season, which could adversely impact on tourism in the area. It would also impact on the levels of grazing the site is presently experiencing, which is considered to be light, since the removal of domesticated grazing.

Deer impact assessments have been carried out since 2003, assessments have been made of deer density, seedling regeneration and browsing levels. The results of a browsing survey, which has been undertaken over the last 2 years clearly show that we are still getting significant browsing across North and South Katrine in spite of low deer numbers. Current browsing levels are at 70% on the north, with average damage of 52% across the catchment. This survey assessed regeneration and evidence indicates that planted trees would suffer considerably worse.

Fencing options

The FCS general policy is to support the use of deer fencing when no reasonable alternative is appropriate. Where fences are unavoidable, their adverse impact should be minimised through careful siting, design (including marking) and later removal when they are no longer necessary. In the context of Loch Katrine achieving woodland expansion through planting is not considered feasible in the absence of deer fencing. The experience at Loch Ard and Loch Lomond where this approach has been undertaken over a number of years indicates that deer bowing of 90% of planted trees is not uncommon even at low densities of 5/km².

The fence options considered are assessed in light of this:

1. No fence option. This option rely's on the need to protect trees through the use of deer control only, the reasons for not adopting this rationale are listed above.
2. Strategic deer fencing. An early solution to maintain differing deer management regimes relied on the use a strategic fence to separate Loch Katrine from the sporting neighbours to the North. This option used short sections of fence to link the natural barriers of Loch Katrine and Arklet to stop deer movements. The cost of this option was prohibitive and would probably not provide the level of protection to any woodland establishment we required and was therefore discounted.
3. Fenced Enclosures. The proposed fencing for Loch Katrine has been considered with due regard to the natural movement of deer and bird strikes. The potential

adverse impact will be minimised through careful siting, design (including marking) and later removal when they are no longer necessary. None of the fences are directly adjacent to public road and therefore deer will not be forced onto the road system, which might create a problem. All the proposed fenced enclosures allow the movement of deer along their natural corridors. At the same time this will ensure that access for hill walkers is unrestricted. The total estimated length of the fences is some 35kms, currently this is split into 33 separate planting blocks, located on the slopes around both lochs. The number of individual enclosures will be reduced to a minimum through the detailed site planning.

Fencing of planting areas will allow existing densities of deer to be maintained over the site and provide more scope for manipulation of grazing levels if required for biodiversity purposes. Fencing of individual blocks will also allow deer to follow usual seasonal movement patterns and allow more scope for out of season visitors to see deer. Compensation culls will be undertaken to ensure that carrying capacity is not exceeded through loss of winter grazing range.

Appendix 2

Outline of planned black grouse mitigation and conservation measures for Loch Katrine project area

All of the following actions will be formalised into a black grouse management plan for the project area and adjacent FES ownership. This will be written and managed by Dave Anderson (District Conservation Manager) and Kenny Kortland (FES Species Ecologist).

Mitigation to reduce fence mortality

1. Number of enclosures reduced (from 35) by merging smaller enclosures, with a concomitant reduction in the length of new deer fencing.
2. All fences marking informed by recent trial by Forest Research.
3. All fences positioned carefully with regard to topography, important habitat areas and position of leks.
4. The length of new fences running directly down hills (i.e. cutting contours) will be minimised.
5. Sections of new fences that are predicted to have the highest likelihood of collisions will be monitored. If significant collisions are found, the fence sections will be realigned or more heavily marked.
6. Fences removed as soon as possible
7. A thorough review of existing fencing will be carried out and all redundant fences will be removed. It is anticipated that significant lengths of fencing – particularly stock fencing on the open hill – will be removed, thus offsetting some of the additional threat posed by new fences.

Planned conservation measures for black grouse

1. Targeted predator control
2. Rotational swiping of ground vegetation.
3. Blocking of drains to create feeding areas for hens and chicks
4. Retention of important tree species where possible – particularly larch
5. Management of tree regeneration on open ground to maintain cover
6. Timing of operations to avoid disturbance to breeding black grouse

It is anticipated that, following the removal of 10,000 sheep from the project area, black grouse productivity will increase. Depending on the practicalities (i.e. effort necessary in relation to data obtained), we intend to monitor black grouse productivity through brood counts. Lek counts will also be carried out. Using these data, we intend to plan conservation action for black grouse on an ongoing basis. For example, if no increase in productivity is detected in the relevant timescale, intervention will be increased. Spatially explicit population modelling – incorporating data from the wider countryside – will also be employed to inform the conservation plan for this species. We will seek to impose an adaptive management framework with appropriate controls. However, this aspiration may be constrained by funding and sample size issues.

Appendix 3

Revised path proposals

Purpose of path/road	Length of new path	Description
Primrose Hill		
<p>Link paths to create several short loops and circuits above and to the west of Brenachoile, and also provide an alternative route back to the Trossachs Pier, via a link from the existing forest road to the Shore road at Silver Strand ; paths are accessed from the shore road at 3 locations and tie in with shuttle boat trips to Brenachoile jetty</p> <p>Higher elevation paths provide stunning views up and down the loch. Additional 2200m will open up a further 5800m of forest roads to access, creating several new circuits.</p>	2200m	<p>Extensions to the existing forest road network of high and mid level paths involving the construction of 1.2-2.0m wide as dug paths, connecting :</p> <p>a) the mid and upper forest roads</p> <p>b) the shore road east of Letter to the mid level forest road. The route follows an existing route that has been graded in places to allow off road vehicle access.</p> <p>c) the extended mid-level forest road, (see Primrose Hill forest road extension below) to the shore road at Silver Strand.</p>
Schoolhouse		
<p>Creation of short high elevation loop as an alternative to shore road through Schoolhouse Wood, accessed from the shore road at two locations to create a loop of 1840m.</p>	740m	<p>Construction of a 1.2-2.0m path extension from the existing road network to the shore road, through Strone Wood.</p>
Stronachlachar		

Purpose of path/road	Length of new path	Description
<p>Creation of a two short walking circuits around Stronachlachar, providing a useful recreational link at this end of the loch.</p> <p>The length of the longer route is 2750m, almost all of this path will use either the proposed military road or private tarred road, the length indicated is the new section required.</p> <p>The short loop of 870m, will use existing roads, the length indicated is the new section required.</p>	750m & 200m	New 1.2-2.0m wide as dug path between the lochside road near the Aqueduct entrance and the Military road.
Ben A'an		
Upgrade of existing subsidiary route to near the top of Ben A'an to create an alternative route.	560m	Upgrading of an existing desire line/hill footpath, with some local erosion, following the end of the existing forest road and up the edge of the conifers following the fence. This will be upgraded to a maximum width of 1.2m using a combination of hill path and as dug construction methods.
Ben A'an		
Upgrade of existing Old drove path through to adjoining land at FCS Groddach. As well as creating a range of local circuits, this will potentially form part of a link to the Glen Finglas path network via Tigh Mhor. Also, through this link, there is potential for connections to the Queen Elizabeth Forest Park and proposed long distance routes to Callander, including National Cycle Route 7 along south shore of Loch Venachar.	750m	Upgrading of an existing old drove road. This will be upgraded to a maximum width of 1.2m using as dug construction methods if required. Most of the upgrade will be delivered by improving drainage along elements of the path.
Military Road		
Creation of a new path, providing safe off road routes for walkers and cyclists.	9800	New 1.2m-2.0m wide path largely following the line of the

Purpose of path/road	Length of new path	Description
<p>This will link the settlements of Inversnaid, Stronachlachar, Aberfoyle and Kinlochard; create long distance links to the West Highland Way; the West Loch Lomond cycle route (via ferry link to Inveruglas) and to the QEFP forest road network. It will create a short circular walk from Stronachlachar and provide access between local tourist facilities (café, bunkhouse, cyclehire and pier) at Stronachlachar and Inversnaid. The route has been identified as a priority path in core path consultations, meets several priorities in the local Community Futures Action plan and safeguards and provides access to the historic road features.</p>		<p>Statute and Military roads. The path leads from the existing Rob Roy View car park, near Inversnaid, across the Arklet dam and along the northern Arklet valley side to a junction near the B829 junction, from which one leg of the road heads east to Stronachlachar and the other south to the FCS forest road at Loch Chon in the QEFP.</p>
TOTAL NEW PATHS	15000m	