HAMPSHIRE RURAL PATHFINDER PROJECT

ENVIRONMENTAL IMPACT ASSESSMENT

Forestry Commission
New Forest

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JUNE 2006

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HAMPSHIRE RURAL PATHFINDER PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

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SUMMARY

Background

The New Forest Site of Special Scientific Interest (SSSI) covers 28,947 hectares of the New Forest. It embraces the largest area of "unsown" vegetation in lowland England and includes a variety of habitat types formerly common but now fragmented and rare in lowland western Europe. These habitats include lowland heath, valley and seepage step mire, or fen, and ancient pasture woodland, including riparian and bog woodland. Nowhere else do these habitats occur in combination or on such a large scale. Much of the SSSI is also designated a Special Area of Conservation (SAC), Special Protection Area (SPA) and RAMSAR Site.

In 2003/2004, 11,000 hectares of the SSSI was considered to be in unfavourable condition. A Public Service Agreement (PSA) target has been set by Government stating that 95% of the New Forest SSSI should be in favourable or unfavourable recovering condition by 2010. The Forestry Commission manages a large part of the New Forest SSSI. Funding has become available over a three year period under the Hampshire Rural Pathfinder Project and guidance from English Nature to progress habitat restoration and improve the condition of 4000 hectares of the New Forest SSSI.

Need For the Works

The main reasons why many of the SSSI units are in unfavourable condition is due to:

- *Problems resulting from a historic legacy of artificial drainage and stream modification which resulted in the straightening of the natural river channels leading to increased erosion and over deepening. Over deepening has also led to the loss of natural flooding on the flood plain which is important for maintaining the ecological condition of riverine and bog woodland and wet grassland (lawns).*
- *Trapping and isolation of pre-Inclosure riverine and bog woodland*
- *Invasion of exotic or non-native species*
- *Scrub invasion in mires and lawns (alluvial/wet grassland)*
- *Poor condition of some 'Ancient & Ornamental' Regeneration Plots*
- *Excess bracken growth constraining natural tree regeneration in localised areas*

The Works

The type of works required to restore the New Forest SSSI comprise:

- *Drain infill*
- *Stream restoration*
- *Debris dams*

- *Crossing points*
- *Conifer removal*
- *Removal of non-native species*
- *A & O Woodland treatments*
- *Scrub management*
- *Fence realignment*

The techniques and materials that will be employed to carry out the works have been used successfully as part of the Life 3 Project aimed at wetland habitat restoration in the New Forest (2002-2006). A great deal of experience has been gained by the Forestry Commission (and other partners) in implementing these types of works including refinements in design and materials

Existing Environment

The New Forest is a unique area, the importance of which is reflected in the number of international, national and local designations. The geology, soils, topography and drainage give rise to habitat types which are rich and varied supporting a wide diversity of flora and fauna. The key habitat types that require works under Pathfinder comprise:

- *Pasture Woodland*
- *Riverine Woodland*
- *Inclosure Woodland*
- *Bog Woodland*
- *Mires*
- *Wet Grassland*
- *Wet Heath*
- *Dry Heath*
- *Ponds & Streams*

The majority of the New Forest SSSI lies on Crown Land which is managed by the Forestry Commission. Much of this land provides an important recreational resource with around15 million people visiting the New Forest each year. Another important use of the land is for Commoning, which is an ancient tradition dating back to Saxon times. Grazing associated with Commoning is important for shaping and maintaining the habitats within the New Forest SSSI.

A number of settlements are distributed around the Forest together with a network of main and secondary infrastructure routes.

The New Forest is drained by six main river basins, notably:

- *Lymington River*
- *Beaulieu River*
- *Avon Water*
- *Bartley Water*
- *Cadnam River*
- *Hampshire Avon Tributaries*

Since the 1870's well over half the total length of main streams and tributaries have been modified to some extent by drainage schemes to improve areas for forestry or grazing. Even so, the rivers and streams still represent an excellent example of a relatively undisturbed lowland river system. The Forest streams are characterised by their flashy nature but during dry summers many of the streams dry out in their headwaters.

Located in the climatic region of central southern England , the New Forest generally experiences warm summers and mild winters. Air quality across the New Forest meets the UK air quality objectives except in very localised areas, which can generally be attributed to traffic congestion.

The Forest contains a unique and special archaeological resource that has been largely well preserved due to the land use history. There are some 2,000 sites of archaeological and historic interest recorded in the New Forest including over 260 Scheduled Ancient Monuments (SAMs).

Indeed the landscape of the New Forest is:

> *"…. an exceptional landscape which has largely escaped the changes brought about elsewhere by modern agriculture and industrial society. Its character still reflects the medieval Royal Forest which covered much of the area. It is a landscape of great beauty, which conveys peace and tranquillity and gives inspiration and great enjoyment to many people. Above all the Forest is a living landscape; its character still shaped by traditional land management and the way of life of local people." New Forest Committee 2003*

Impacts & Mitigation

Impacts and mitigation have been considered in relation to:

- *Human Beings*
- *Flora & Fauna*
- *Soil*
- *Water*
- *Air*
- *Climatic Factors*
- *Material Assets – Archaeology & Cultural Heritage*
- *Landscape*

It is anticipated that the Pathfinder works will restore up to 4000 hectares of the New Forest SSSI into favourable condition through the removal of exotics and invasives, restoration of the original drainage system, restoration works in the 'Ancient & Ornamental' woodlands, scrub management and opening up areas to grazing through fence realignment. This will have significant benefits for the habitats (particularly wetland habitats) and ecology of the New Forest SSSI through:

- *Restoration of flooding to the floodplain thus restoring seasonal flooding and associated natural processes which are vital for maintaining the quality of riverine and bog woodland and wet grassland*

- *Improvements in habitat quality and niches for macroinvertebrates and fish.*

- *Increase in suitable habitat for breeding waders*

- *Improvements in the quality of the A & O Inclosure plots to help restore their condition and link them better into the original A & O woodland*

It is also hoped that the works will provide some benefits to the Commoning Community with the provision of increased grazing from:

- *Scrub management on Mires and Alluvial grassland.*

- *Fence realignments opening up additional areas of Inclosures for grazing*

- *Restoration of seasonal flooding on wet grassland (lawns) providing additional nutrients to the sward*

- *Improved safety to stock from infilling of deep ditches and holes*

It is also possible that the in-stream works will reduce the magnitude of downstream flood peaks by reactivating the floodplain in the upper catchment which may give some degree of benefit to downstream flood alleviation. Modelling will be required to determine how significance the benefit would be.

It is impossible to carry out the works without some degree of disturbance to the local environment during the construction period but the use of good practise techniques and careful planning should help mitigate and limit the degree of disturbance. Operational Site Assessments and consultation with relevant parties will be key in identifying and dealing with the most sensitive issues. Most of the negative impacts are short term and minor. Those issues which require particular consideration relate to:

- *Disturbance to recreational users*
- *Damage to the soil surface from machinery and plant*
- *Protection of water quality, fish and macroinvertebrates during in-stream works*
- *Protection of archaeological sites*
- *Landscape/aesthetic changes*
- *Air quality and fire safety issues associated with controlled burning*

1. INTRODUCTION

1.1 Background

The New Forest Site of Special Scientific Interest (SSSI) covers 28,947 hectares of the New Forest (Figure 1.1). It embraces the largest area of "unsown" vegetation in lowland England and includes a variety of habitat types formerly common but now fragmented and rare in lowland western Europe. These habitats include lowland heath, valley and seepage step mire, or fen, and ancient pasture woodland, including riparian and bog woodland. Nowhere else do these habitats occur in combination or on such a large scale. Much of the SSSI is also designated a Special Area of Conservation (SAC), Special Protection Area (SPA) and RAMSAR Site. The citation sheet for the New Forest SSSI is given in Appendix A.

In 2003/2004, 11,000 hectares of the SSSI was considered to be in unfavourable condition. A Public Service Agreement (PSA) target has been set by Government stating that 95% of the New Forest SSSI should be in favourable or favourable recovering condition by 2010.

For the purposes of condition assessment the New Forest SSSI has been divided into some 582 units. The main reasons why many of the SSSI units are in unfavourable condition is due to problems resulting from a historic legacy of artificial drainage and stream modification, invasion of non-native species and scrub encroachment.

The Forestry Commission manages a large part of the New Forest SSSI. Funding has become available over a three year period under the Hampshire Rural Pathfinder Project and guidance from English Nature to progress habitat restoration and improve the condition of 4000 hectares of the New Forest SSSI.

1.2 Requirement to prepare an Environmental Impact Assessment (EIA)

The nature of the works mean that they do not fall neatly under any specific Environmental Impact Assessment (EIA) Regulations. Components of the work have already been covered under the EIA prepared for the Forest Design Plan[1] and are covered under an existing felling licence. Other components such as the drainage works are dealt with under Land Drainage Consent under the Land Drainage Act 1991 (as amended) but are too small scale to require the preparation of a full Environmental Statement. A significant proportion of the works also require consent from English Nature under the Wildlife & Countryside Act 1981 (section 28H) and the Verderers – New Forest Act 1970 (section1)

Given the extent of small to medium scale works that the Hampshire Rural Pathfinder Project covers and the sensitivity of the environment in which they are being carried out (be it with the aim of habitat improvement) the Forestry Commission (New Forest

[1] Forestry Commission (1999) Environmental Impact Assessment for the Deforestation of Part of the New Forest

District) consider that in terms of good practice it is prudent to prepare an outline Environmental Impact Assessment in order to:

- Identify key issues and impacts associated with works
- Design appropriate mitigation to minimise any impacts
- Assist with gaining statutory approvals where required

1.3 Organisation of the EIA Report

The EIA report is divided into six chapters:

Chapter 1 outlines the background and reasons why an EIA is being prepared

Chapter 2 outlines the need for the Project

Chapter 3 identifies locations of the work sites and type of work that will be carried out under the Pathfinder Project

Chapter 4 highlights the existing environment, nature of the impacts and requirements for mitigation/enhancement by topic. The topic areas addressed are:

- Human Beings
- Flora & Fauna
- Soil
- Water
- Air
- Climatic Factors
- Material Assets – Archaeology & Cultural Heritage
- Landscape

Chapter 5 identifies and evaluates the impacts (during and post construction) associated with the works and highlights any mitigation of enhancement that will be required.

Chapter 6 outlines the consultation process that is being followed

1.4 Key Sources of Data

In preparing this EIA Report information has been drawn from existing published and unpublished reports, data and records kept by statutory bodies and key individuals and through consultation with staff both in the Forestry Commission and other stakeholder groups. A full reference list is given at the end of this report.

2. NEED FOR THE WORKS

Under the Public Service Agreement, 95% of the New Forest SSSI is required to be in favourable or unfavourable recovering condition by 2010. In 2003/2004, 11,000 hectares (38%) of the SSSI was considered to be in unfavourable condition. The key reasons why units are considered to be in unfavourable condition are as follows:

I. Historic Drainage & Channel Modification

The New Forest streams are of considerable geomorphological and ecological interest in their own right, but they also contribute to the function and condition of other SSSI habitats – notably alluvial/riverine woodland, mires, wet grassland and bog woodland. Seasonal flooding within the floodplain is particularly important and mires control the source and flow of water to the head streams.

However, the New Forest streams have been undergoing modification since the 1870's (possibly as early as 1840's) with further large scale modifications though the 1950's – 1970's to improve ground conditions for forestry and grazing. This drainage has had a number of undesirable effects:

- Canalisation through straightening, over deepening and over widening of the river channels has led to a change in channel morphology and width/depth ratio. The resulting loss of meanders and overall reduction in stream length causes water to run through the shortened channel section more rapidly and with more force. In addition over deepening and bank-side spoil reduces the opportunity for out of bank flow and flooding of the floodplain.

- Prevention of natural flooding means that more energy is concentrated within the river channel itself resulting in increased erosion and transport of gravel. These gravels are deposited further downstream where the channel gradient reduces. This can result in the reduction of the channel capacity downstream, which in turn may cause drainage problems elsewhere.

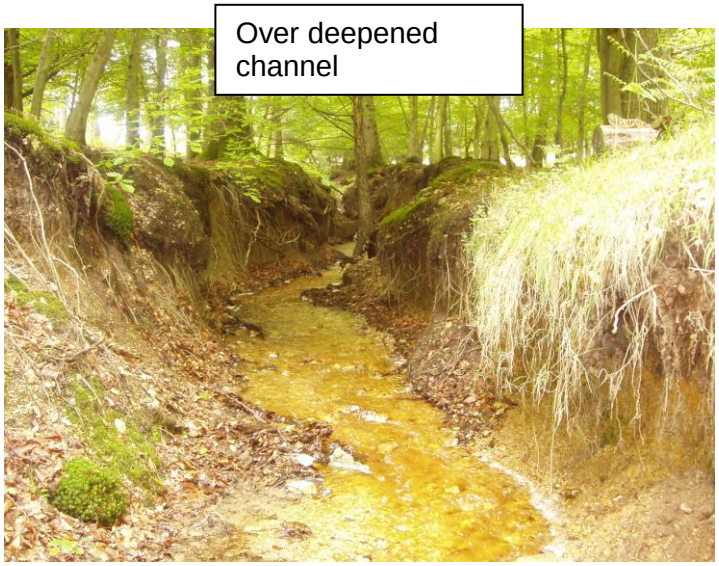
- As the river tries to adapt to its new lowered stream bed level it creates headward erosion, often into the valley mires. In some places creeping headward erosion has led to deeply incised channels in the order of 1.5m-3.0m deep and lowered the water table in the surrounding floodplain. Tuckfield (1976, 1980) studied the effects of channel and drainage modification of the New Forest Streams and noted that headward erosion could exceed 1 metre per year and volume of material eroded due to human intervention has been found to exceed $0.5m^3$ per metre of channel per year.

- Where new Inclosures were created following the Deer Removal Act 1851, streams inside the Inclosures were often straightened and side drains cut into tributary valleys. The straightening of channels was usually restricted to within the Inclosure Boundary and indeed the 1870 1:2500 Ordnance Survey maps show many of these new drains originating at the boundary of the Inclosure. Over the years these drains

have deepened significantly and migrated headward well beyond the boundary fence onto the Open Forest.

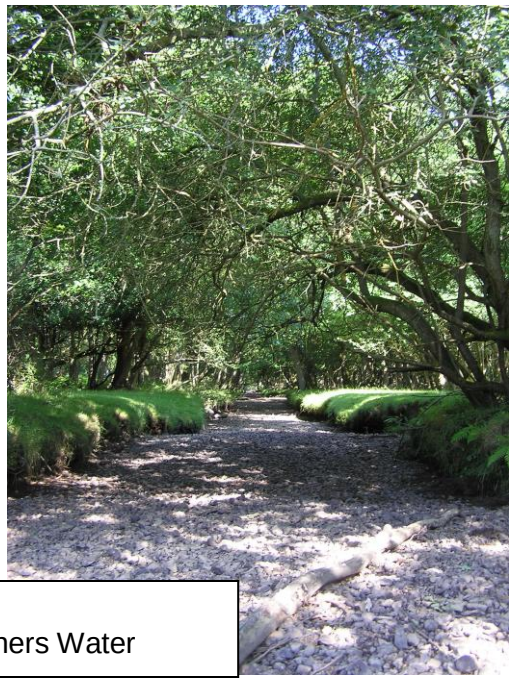
- Spoil heaps adjacent to watercourses act like flood banks which reduce the potential for over banking and flooding on to the natural floodplain. Conversely, they also prevent water from draining back into the streams during periods of high rainfall.

- Channelisation also leads to development of an in-stream mono habitat. Loss of bed substrate can lead to a reduction in trout spawning habitat.



Over deepened channel

Advancing nick point Broomy/Amberslade



Straightened Channels
L – Pitts Wood, R- Fletchers Water

Relic meanders
L- Knightwood, R- Pitts Wood

II. Trapped pre-Inclosure riverine and bog woodland

The process of enclosure combined with the effects of historic drainage and channel modification has resulted in the isolation and degradation of stands of alder and ash woodland and alluvial grassland that would have in the past bordered New Forest steams in a rich mosaic of wooded and open habitats. The maintenance of this woodland or restoration to a favourable condition requires that the full range of fluvial processes be allowed to function within a physically, hydrologically and geomorphologically intact natural or near natural system. Periodic flooding of the riverine woodland stands is essential.

III. Invasion of Exotics

Species such as Rhododendron, American Strawberry (*Gaultheria shallon)*, Sycamore, Turkey Oak, Sweet Chestnut, Red Oak, and Scots Pine and other coniferous species have been introduced as a result of natural colonisation or deliberate planting. It is considered that they can detract from the natural species diversity of woodland habitats and take up space that could be used for native species. However, some species are far more troublesome than others (See Table 2-1). In addition, other alien wetland loving species, notably Himalayan Balsam (*Impatiens glandulifera*), Parrots Feather (*Myriophyllum aquaticum)* and Australian Swamp Stonecrop (*Crassula helmsii)* are invading streamsides and ponds. These species can be extremely invasive, highly damaging to native flora and fauna and difficult to control or eradicate.

Scots Pine is a common sight in the New Forest and an important component of the landscape. The majority of present day pines are said to have arisen from stock planted in 1745. But there is also the view that Scots Pine was abundant in prehistoric times and that some stock may have survived to the present day. Pines readily colonise heathland and although there is little concern about the seed shadow of trees standing within woodland, there is concern about trees on woodland margins and edge of glades which pose a significant threat to the integrity of surrounding heath and lawn habitat.

IV. Scrub

Although scrub is a natural and valuable component of New Forest habitats, where alluvial grassland and mires have dried out over the years following drainage, scrub has been steadily invading. It can be particularly prevalent around spoil banks which form drier islands for scrub to establish on. Without active management this scrub can become a problem on these habitats due to its spread and shading characteristics. There is particular concern that spread of scrub over alluvial grassland (lawns) is leading to a significant loss of grazing potential.

Scrub invasion on a lawn

Table 2-1: Pests & Exotics

Exotic	Characteristics
Rhododendron	A highly invasive shrub introduced from Asia as a garden ornamental shrub. Abundant in private grounds throughout the New Forest and surrounding area. It has negligible nature conservation or browse value. Its provides dense shade which excludes ground flora. Its litter and leachates also have a sterilising effect on the soil.
Gaultheria shallon	Invasive ericaceous shrub from NW America. Spreads by a system of underground rhizomes. Its leathery leaves resist penetration by herbicides and once established it dominates the ground and understorey layers of wood and heath.
Turkey Oak	Introduced into Britain from the Balkans around 1750, and has been present in the New Forest in the late 19th or 20th century. It is invasive and is usually present as a small number of mature trees amongst a host of younger stems. It is of little timber value as it is prone to warping and shrinkage. A key host to the knopper gall. Can hybridise with native oaks thus compromising the genetic make up of native oak in the New Forest.
Scots Pine	Although once native in the Forest the present trees have developed from introduced stock. Initially used as a nurse crop for broad leaved plantings. Highly invasive and where dense stands occur they act as a significant constraint on regeneration of native species.
Sweet Chestnut	Introduced to Britain by the Romans as a source of nuts for food and has been present in the New Forest since at least the 14th century. Although its nuts are valued as a source of food for wildlife, it is non-native and does not support the wealth of insects and lichens found on mature native oak and beech. Its leaf litter is rich in tannins and breaks down very slowly, creating soil conditions that do not favour woodland herbs and mosses.
Red Oak	Introduced from North America as an amenity tree. Like Sweet Chestnut it does not support a rich insect or lichen community
Other species	A number of other non-native species have been planted in more recent times including hybrid lime and various conifer species such as Western Hemlock, Douglas fir, Lawsons cypress and Norway spruce
North American skunk cabbage	Recently found in some mire systems
Japanese knotweed	Garden escapee which colonises along river banks and can become very invasive.
Crassula helmsii (Australian Stonecrop)	An aquatic plant from Australasia. Invasive in permanent and temporary ponds where its rapid growth creates a blanket cover which out competes native flora with associated impacts on invertebrates. Present in many temporary and permanent ponds through out the Forest
Himalayan Balsam (Impatiens glandulifera)	Introduced from Asia as a garden exotic which has subsequently escaped and colonised riverbanks. Rivers provide a mechanism for its spread and colonisation.

Significant Pest species, Exotic/Invasive, Minor Exotic

V. A & O Regeneration Plots

As a consequence of the 1949 New Forest Act some 57 areas of woodland within the Ancient and Ornamental Woods were enclosed in small plots of less than 20 acres between 1953-1965. These plots are commonly referred to as the A & O Regeneration Plots. A condition of their enclosure was that they must be thrown open to stock once regeneration had been secured and indeed all (except Gibbet Wood) have been thrown open. The original intention behind the enclosures was to secure the regeneration of the

ancient woodland by management intervention as it was feared by foresters of the time that the Ancient and Ornamental Woodland was at risk of degenerating due to lack of natural regeneration. The standard management treatment was to clear about 50% of the original old woodland retaining strips and groups to promote natural regeneration. However when this technique did not succeed the cleared areas were often planted with stands of pure oak in a matrix of beech.

Today the condition of these A & O Regeneration Plots varies considerably and a number contain non-native trees and exotics including Red Oak, Grey Alder, Turkey Oak, Southern Beech and Rhododendron. Some are barely distinguishable from the character of the surrounding A & O Woodland while others still vary considerably. Four typical stand classes can be found (Spencer, 1996):

- Stands of mixed planted and self sown oak, beech and birch characterised by closely spaced young high forest stands, although some have been thinned to plantation like stands of oak and beech
- Stands similar to above but with additional planted stems of non-native trees
- Stands similar to above but with additional planted stems of native trees that are considered inappropriate to the site, for example, beech planted within former pure oak stands.
- Stands where the canopy has been thinned rather than clear felled with natural regeneration of birch,holly, beech and other natives within the wood

In order to improve the condition of the SSSI Units, there is the need to carry out selective and appropriate management to re-integrate the A & O Regeneration Plots into the surrounding, adjacent A & O Woodland.

VI. Bracken and tree regeneration

Bracken growth can be very prolific on the lighter sandy, gravely or acidic soils of the Forest. Bracken competes strongly with young trees and other vegetation for light during the latter part of the growing season. In the autumn it dies back and collapses which can also smother and kill young trees. Although it is an important component of the woodland ecosystem, there are localised areas where there is concern that the density of bracken is constraining natural tree regeneration and in those areas there is a need for bracken control.

The type of works required to restore the New Forest SSSI to favourable or unfavourable recovering condition are described more fully in Chapter 3.

3 THE WORKS

3.1 INTRODUCTION

The type of works required to restore the New Forest SSSI comprise:

- Drain infill
- Stream restoration
- Debris dams
- Crossing points
- Conifer removal
- Removal of non-native species
- A & O Woodland treatments
- Scrub management
- Fence realignment

The techniques described in this chapter have been used successfully as part of the Life 3 Project aimed at wetland habitat restoration in the New Forest (2002-2006). A great deal of experience has been gained by the Forestry Commission (and other partners) in implementing these types of works including refinements in design and materials. Monitoring is still on-going on the Life 3 works but the techniques described below are considered to be the most appropriate for carrying out the necessary work to restore the New Forest SSSI.

3.2 LOCATION OF THE WORKS

The location of the sites is shown in Figures 3.1 to 3.9. A summary of the nature of the works is given in Tables 3-1 to 3-6 in relation to the six main river basins prevailing the New Forest (Figure 3.10).

Table 3-1: LYMINGTON CATCHMENT

Site	SSSI Unit	OF/I	Type of Works								
			Stream Restoration	Drain Infill	Debris Dams	Crossing Points	Conifer Removal	Removal Non-natives	A & O Woodlands	Scrub Management	Fence Re-alignment
Aldridge Hill	502	I						◆			
Barrow Moor	373	OF		◆							
Berry Wood	136	OF						◆			
Berry Wood Bottom	128	OF		◆							
Bratley Wood	134	I						◆[1]			
Burley New West	365	I		◆			◆	◆			◆
Clumbers	502	I						◆			
Dames Slough	363	I	◆					◆			
Edge of Woosons Hill	347	OF		◆				◆			
Fletchers Thorns	499	I		◆			◆	◆			
Fletchers Water	476	OF	◆								
Knightwood	362	I	◆					◆			
New Copse	460	OF		◆		◆			◆		
Ober Water/Markway Lawn	339	OF		◆							
Parkhill Wood	398	OF						◆	◆		
Perrywood Ivy/Haseley	569,570	I			◆			◆			
Poundhill Inclosure	504	I					◆	◆			
Puckpits	358	I		◆							
Queen's Meadow/Driver's Nursery/Camel Green	503,475, 497	OF	◆								
Slufters North & South	113, 114	I		◆							
Slufters south mires	81	OF		◆							
South Oakley	366	I		◆							
South Oakley	561	I		◆			◆				◆
Vinney Ridge	500	I		◆				◆			

[*1] Includes Bracken management

Table 3-2: HAMPSHIRE AVON TRIBUTARIES

Site	SSSI Unit	OF/I	Type of Works								
			Stream Restoration	Drain Infill	Debris Dams	Crossing Points	Conifer Removal	Removal Non-natives	A& O Woodland	Scrub Management	Fence Re-alignment
Amberslade/ Broomy West	552	OF		◆							
Amberwood	46	I		◆							
Claypits Bottom	30	OF		◆							
Cranesmoor	131	OF					◆				
Ironswell Wood & Howen Bushes	59	OF						◆	◆		
Islands Thorns	540	I		◆	◆						
Islands Thorns mires	46,47	OF		◆							
Milkham	116,97,98	I	◆	◆				◆			
North & South Bentley	550,118	I		◆							
Pitts Wood	543	I	◆								
Rakes Brakes Bottom	52	OF		◆			◆				

Table 3-3: BEAULIEU

Site	SSSI Unit	OF/I	The Works								
			Stream Restoration	Drain Infill	Debris Dams	Crossing Points	Conifer Removal	Removal of Non-natives	A & O Woodlands	Scrub Management	Fence Re-alignment
Crab Hat	566	I		◆		◆					
Denny Inclosure East	407	I		◆							
Denny Lodge NNW	488	I		◆							
Frame Heath	458	I		◆							
Hawkhill	464	I	◆				◆				
Kings Copse (Dark Water)	568	I		◆	◆						
Mallard Wood	394	OF						◆	◆		
Parkhill Lawn	386	OF					◆	◆		◆	
Pondhead	404	I			◆			◆			
Stockley	463	I		◆			◆				

Table 3-4: Bartley Water

Site	SSSI Unit	OF/I	The Works								
			Stream Restoration	Drain Infill	Debris Dams	Crossing Points	Conifer Removal	Removal Non-natives	A & O Woodlands	Scrub Management	Fence Re-alignment
Ashurst Wood	395	OF						◆	◆		
Brockishill/Dogben Gutter	401,564	I		◆							

Table 3-5: Cadnam

Site	SSSI Unit/Size	OF/I	The Works								
			Stream Restoration	Drain Infill	Debris Dams	Crossing Points	Invasives Removal	Removal Non-natives	A & O Woodland	Scrub Management	Fence Re-alignment
Bramshaw Golf Course	72	OF		◆		◆					
Bramshaw High Beeches/Brookwood	99	OF						◆	◆		
Coppice of Linwood	109	OF		◆							
Crows Nest Wood	544	OF							◆		
Gibbet Wood	100	OF							◆		
King's Garn Inclosure	111	I									◆
Longbeech	112	I		◆							
Shave Green East	400	I									◆

Table 3-6: Avon Water

Site	SSSI Unit	OF/I	The Works								
			Stream Restoration	Drain Infill	Debris Dams	Crossing Points	Invasives Removal	Removal Non-natives	A & O Woodland	Scrub Management	Fence Re-alignment
Broadley Inclosure	535	I		◆							
Wootton/ Brownhills	537	I		◆							

OF – Open Forest, I - Inclosure

3.3 TECHNIQUES

3.3.1 Drain infill using heather bales

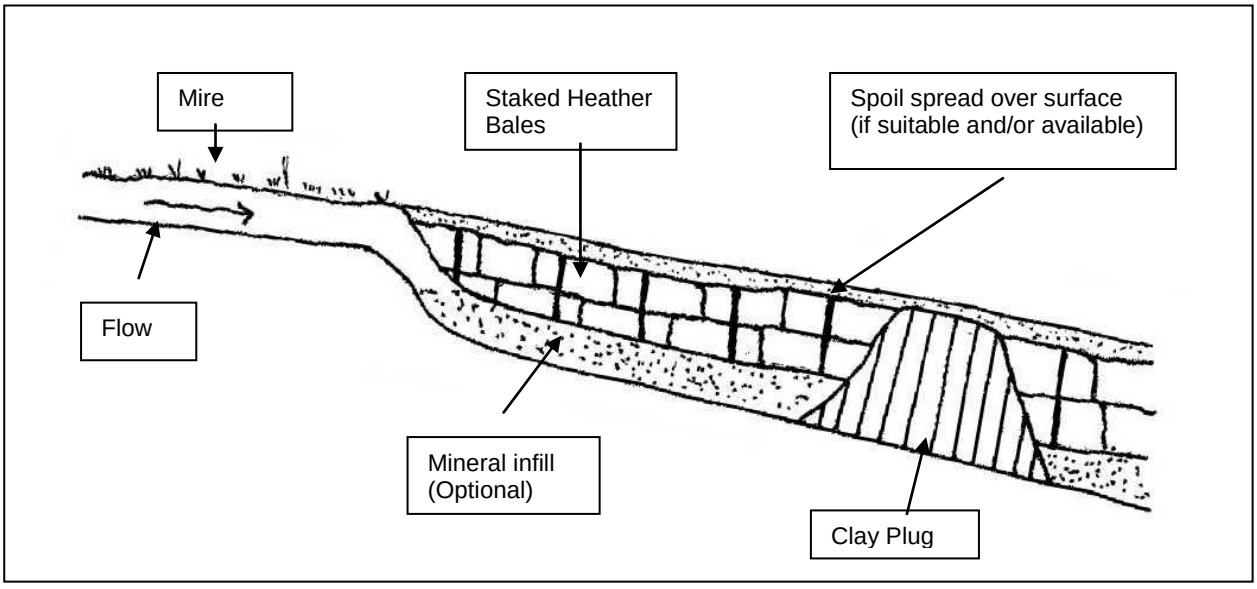
The key aim of Mire Restoration is to halt the nick-point erosion and prevent any further erosion cutting back into the mire system and lowering the water table. The work often aims to remove the artificial drainage patterns. The most successful technique to date has been the use of heather bales to plug and infill the channel. Heather bales (*Calluna vulgaris*) are cut locally from the forest and provide a cost effective and fairly robust method of infilling. The bales (75 cm x 50cm x 50cm) are packed in and held in place by chestnut stakes.

An advantage of using heather bales is that they can be used at points of headward erosion to support the leading edge of the peat and halt erosion by conveying water over the bales and on downstream. To avoid subsidence and degradation of the infill the water table needs to be supported throughout the year so that the bales are submerged. The bales can do this themselves by infilling with sediment and therefore becoming impermeable. However, to ensure success it is best to create impermeable dams of spoil or clay at intervals along the drainage channel to support the water level over the bales. When submerged and receiving inputs of fines and organic matter, the bales readily become colonised by mire and soakway plants. Spreading remaining spoil over the surface of the bales once they have been installed can accelerate this colonisation and provide some additional stabalisation. Concerns have been raised by the commoning community with respect to the string holding bales together, but it is the Forestry Commission's opinion that the bales are robust to livestock and are not a hazard.

Heather bales can be produced by request as part of the winter management of the Open Forest heathlands, particularly dry heathland management. A maximum of 12,000–14,000 bales can be produced in a winter. The limiting factor is their durability during storage. The bales need to be used within a year of being produced to avoid degradation.

A general diagram illustrating this technique is shown in Figure 3.11 and a series of photos showing works already undertaken successfully in the New Forest SSSI are presented below.

Figure 3.11: Infill using heather bales & clay plugs



Harvesting heather bales

Contractors stockpiling heather bales along ride edge ready for mire restoration and drain infill works

Over deepened ditch cleared ready for infill works.

Contractors infilling drainage channel with heather bales

Two weeks after completion water levels have been raised to more natural heights

ALTERNATIVE BUT LESS SUCCESSFUL MIRE RESTORATION TECHNIQUES

Gabion baskets

The first work undertaken by the FC in this area was in the early 1990's when efforts were made to halt the headward erosion of drainage channels into mire peats. Gabion baskets were installed at the point of erosion to support the leading edge of the peat. These wire cages were filled with 'rejects' (oversize gravel) to provide a robust material over and through which the head of water could descend from the level of the mire down into the drainage channel. The success of this technique has varied. The wire of the baskets is vulnerable to the acid waters of the mire (which is thought to remove the protective zinc coating and thereby exposes the underlying steel to the elements). Aside from the reduced structural integrity, exposed and broken wire is a potential hazard livestock and people. The water exiting the mire did not always flow over or through the gabion, and in several instances the peat has continued to erode upstream of the gabion. In essence they were an attempt to halt erosion but were not sustainable. Examples include Picket Post Bottom, Stony Moors, Holm Hill/Silver Stream.

Brushwood faggots

This technique was trialed in LIFE 2 but was not particularly successful (possibly because it was not applied in a suitable way). The preparation of the material involves bundling the tops of birch using twine (either degradable or plastic). These bundles can be packed in to drainage channels and staked to prevent movement. Water flowing over and through this material will deposit fines and organic matter which should aid consolidation of the infill and provide a firm substrate that is safe for livestock to cross (and for vegetation to colonise). However, at the site where it was trialed (Blackensford in 1999) it was used to prevent headward erosion, an application for which it is not suitable. It would have the best chance of success where it forms part of the material used to infill a channel (eg. Used in combination with bank spoil) and where the water table remains above the birch throughout the year (so as to prevent rapid decay/rot). It would therefore also need to be used in conjunction with clay plugs.

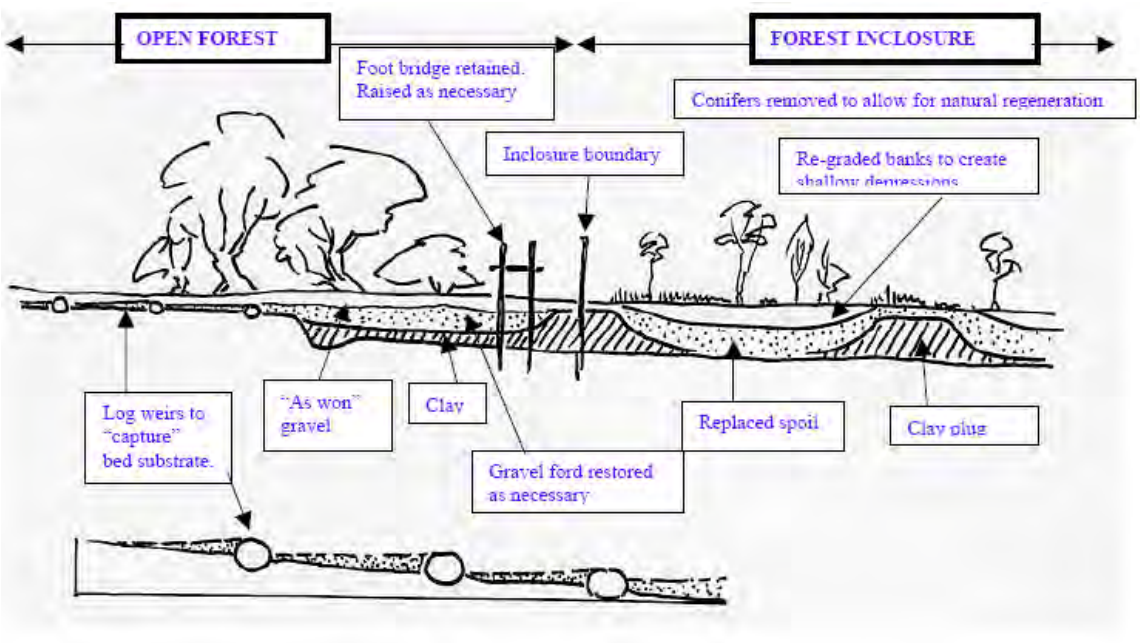
3.3.2 Stream Restoration

A number of techniques will be used for stream restoration depending upon the location and nature individual stream reaches. The different techniques likely to be used are outlined below.

A) Installation of Log Weirs

Where bed gravels have been scoured and lost from headwater sections of a stream but where the solid geology (e.g. underlying clay) is still intact, low log weirs (Figure 3.12) can be installed in the river bed to act as sediment traps. The weirs capture and retain any gravels that still remain in that part of the system or that are being washed down from further upstream. They also help to stabalise the bed and prevent erosion and scour progressing further upstream.

Figure 3.12: Use of Log Weirs



Source: Environment Agency

Log weirs – Holmsley Inclosure

B) Bed level Raising

Where channels have become over deepened due to scour and erosion it is often necessary to raise the bed back up to the original level using infill material as closely matched in character to that originally lost. Local sources of material include:

- Local Quarries – e.g. Hamer Warren (Cemex), Pennington (New Milton Sand & Ballast)
- Areas along the stream network where excess eroded gravels have been deposited
- Spoil Heaps

In order to prevent the new material being washed out, malleable clay plugs can be used in limited areas to form cells to hold the material in place on the upstream side. Over time the river will naturally sort and regrade the new material into a natural bed form. Where appropriate, the new raised bed level can be used to re-connect the river into former meanders on the downstream side as described further below.

Past attempts to reduce erosion by infilling with branchwood failed

Bed level raising Blackensford Brook

C) Restoration of flow back into natural meanders

Once bed levels have been raised as appropriate upstream, the channel can be restored to its natural course by the reinstatement of the original channel and old meanders (Figure 3.13).

The design of the meanders where possible should follow the original course of the river by linking up the old paleomeanders. The course of the old meanders is usually possible to trace through topographic remnants and patterns of organic debris on the floodplain supported by survey work and reference to historic maps. Excavation of the soil surface often reveals the gravels forming the original river bed. Where this is not clear trial holes can also be dug to establish original bed levels. Usually it has only been necessary to scrape back the organic debris to reveal the old substrate with an emphasis on under rather than over excavation and a preference for leaving the river to wash out any remaining excess organic debris.

In order to connect the river to its restored channel the straightened channel is blocked off using a plug of compacted malleable clay topped off with material from surrounding excavations or excavated spoil banks. A similar plug may also be required at the downstream end if the old channel is being backfilled depending upon location and fisheries issues. It may also be necessary to incorporate a v-notch in the downstream plug to facilitate fish passage. It is important that the plug is set at a high enough level and is big enough to deflect flows into the new restored channel. Experience has shown that clay plugs can breach when water is allowed spill directly over the plugs during times of flood flow, particularly in the period post restoration before material has had a chance to consolidate.

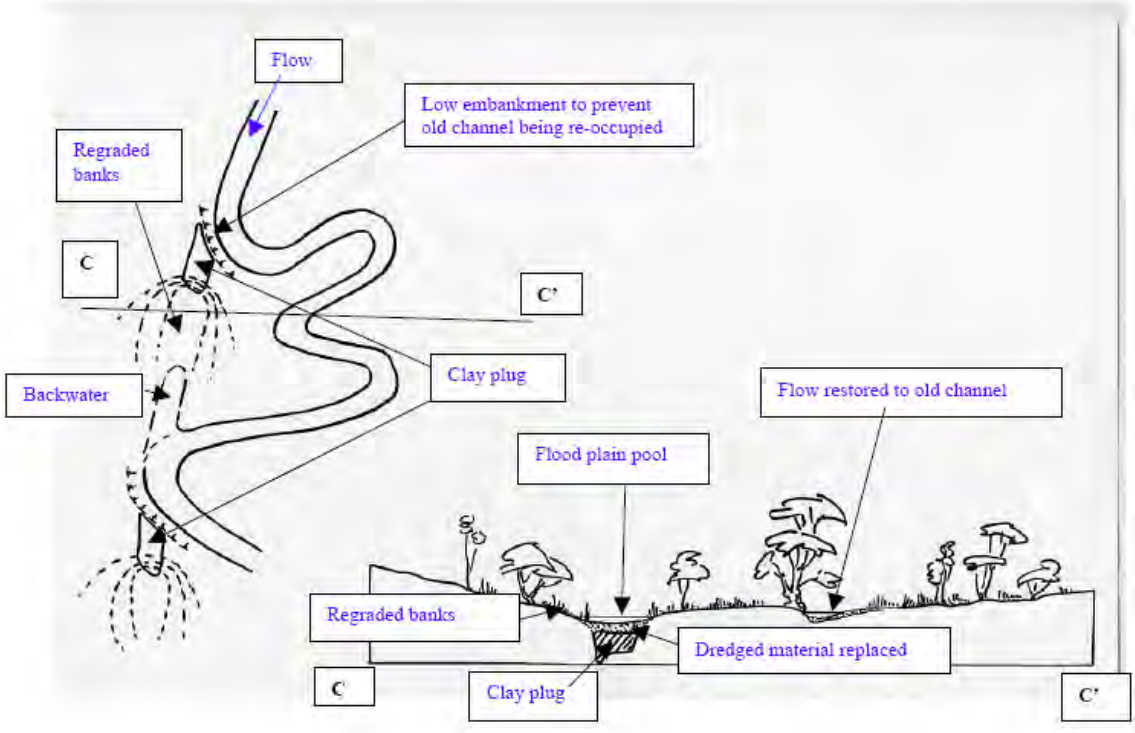
Once the river has been diverted into its newly restored channel, it is preferable to fill in the old straightened channel with excess material from old spoil banks and material excavated in the process of restoring the new channel. Although it can take substantial material to do so is preferable to fill in the old channel because:

- Leaving the old channel open will cause it to function as a deep ditch drawing in water from the surround floodplain.
- At times of raised flow it can act as a long backwater trapping fish when the water level falls again. The creation of short backwaters can add diversity and provide large pools as seen at the lower end of the Highland Water restoration works.
- Leaves potential for the new channel to breach back into the old channel especially where the two channels run close to one another and run out of bank during times of flood flow.
- Potential safety hazard

Where there is a shortage of fill material, large conifer tree trunks and stumps which would otherwise be removed from the floodplain can be used to provide bulk fill before being covered with mineral infill. However, consideration needs to be given to any pollution risk from the degradation of organic material.

In other sections it may be appropriate to partially infill and/or regrade the channel banks to form shallow hollows or floodplain pools.

Figure 3.13: Restoration of natural meanders



Source: Environment Agency

Meander restoration – Highland Water

Palaeomeanders – Ober Water (Markway)

Excavating palaeomeanders

Constructing clay

Restored meander

Restoration of flooding to the floodplain

D) Installation of Debris Dams

Debris dams are important components in restoring a river and it's associated habitats. When considering the use of debris dams as a restoration technique it is important to consider the individual river reaches and determine whether they would naturally support debris dams depending upon the nature of the surrounding habitat relative to the availability of woody debris. For example stream reaches running through open heathland (e.g. Ditchend Brook) are less likely to support the density of debris dams found in the highly forested catchments such as Highland Water or the lower reaches of the Beaulieu.

It can take tens or even hundreds of years to form dams by natural processes depending upon the availability of large woody debris (LWD). However, the provision of woody debris can be accelerated as a by-product of complimentary activities such as pollarding of ash, oak and holly species. The arising can contribute to flood plain flow processes or can help the formation of in-steam debris dams if they are washed into the channel. In order to further secure the availability of natural woody debris to supply debris dams it is recommended that where possible natural tree and branch falls are left in situ where they fall on a floodplain. This is in line with the Timber Management Protocol agreed between the Environment Agency, English Nature and the Forestry Commission (Appendix B).

However, the presence of straight, cut material can create an impermeable debris dam that can be detrimental to the movement of fish. This is particularly relevant to the harvesting of conifers on the floodplain within Inclosures and in such instances such timber/arisings should be removed from the floodplain***.***

To further aid the natural process, large pieces of woody debris can be introduced into the channel:

- By placing individual pieces of debris in stream using machines
- Push over adjacent trees so that either the branches or trunk are in the stream
- Felling adjacent trees but retaining a hinge so that the tree is still alive
- Digging in live material that has been cut for the purpose, for example willow or alder

When placing woody debris in channel the following general principles need to be considered (Mott, 2005):

- The length of the pieces should be at least as long as the channel width
- The diameter needs to at least 0.1m or 5% of the channel width (whichever is the largest)

- The Large Woody Debris may need to be securely keyed into the bed of the watercourse at an angle of 20°-40° to the channel/flow direction.
- In highly wooded catchments, to replicate the natural density of New Forest debris dams it is recommended that very large pieces of woody debris are placed across the channel at 150m intervals. Once a key piece is in place natural processes will do the rest when debris becomes snagged during times of flood flow.

Debris dams can be critical in maintaining and building up bed levels. In some reaches where damage is not extreme, bed levels in the existing channel may have remained fairly constant. In such locations the strategic placement of debris dams may be the only restoration technique required, allowing the river's own dynamic processes to do the restoration.

Natural debris dam
Avon Water

Constructing a debris dam

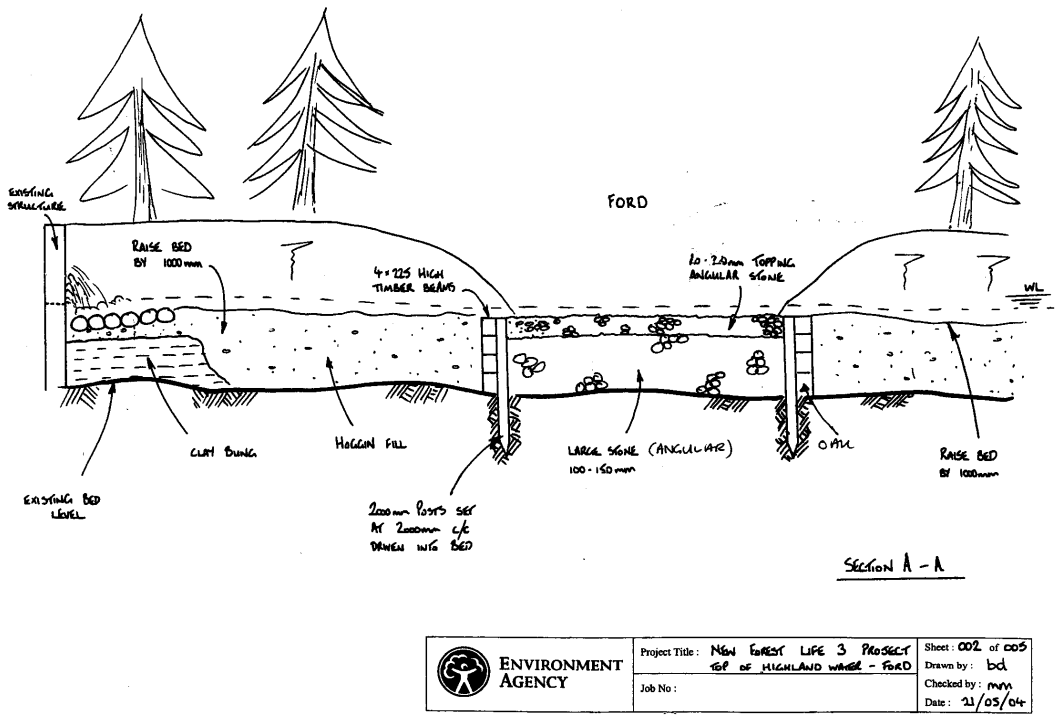
In accordance with its former duties, the Forestry Commission has historically been responsible for the removal of woody debris to maintain free-flowing watercourses. This has been undertaken for many decades and as a consequence the streams of the Forest are impoverished in respect of woody debris. Moving away from the traditional management of woody debris to a more enlightened view has required a cultural shift among staff in this organisation. To disseminate the understanding of the role of woody debris, the Forestry Commission has written a policy document (Appendix N) for the New Forest in consultation with English Nature and the Environment Agency. This has been presented to staff to encourage a more sensitive approach to the management of riparian corridors.

3.3.3 Crossing Points

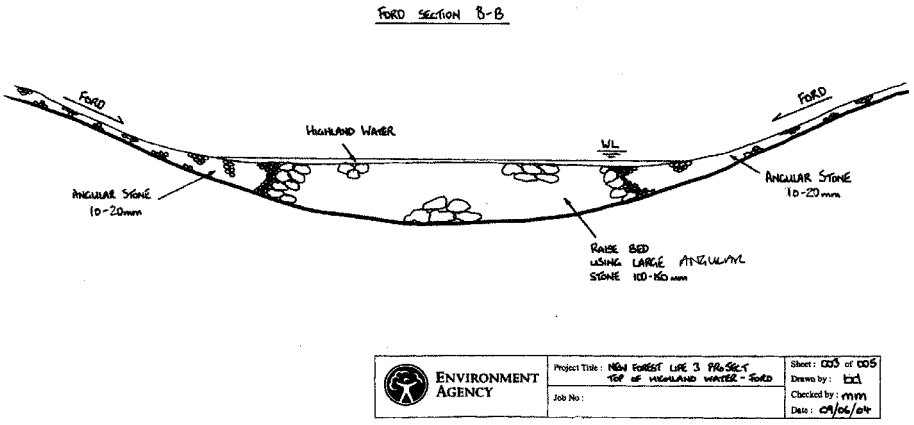
Crossing points are essential to allow safe points for horse riders and stock to ford a stream. Typical designs for a stream crossing are shown in Figure 3.14a-d.

Figure 3.14 Design of typical stream crossing (Ford)

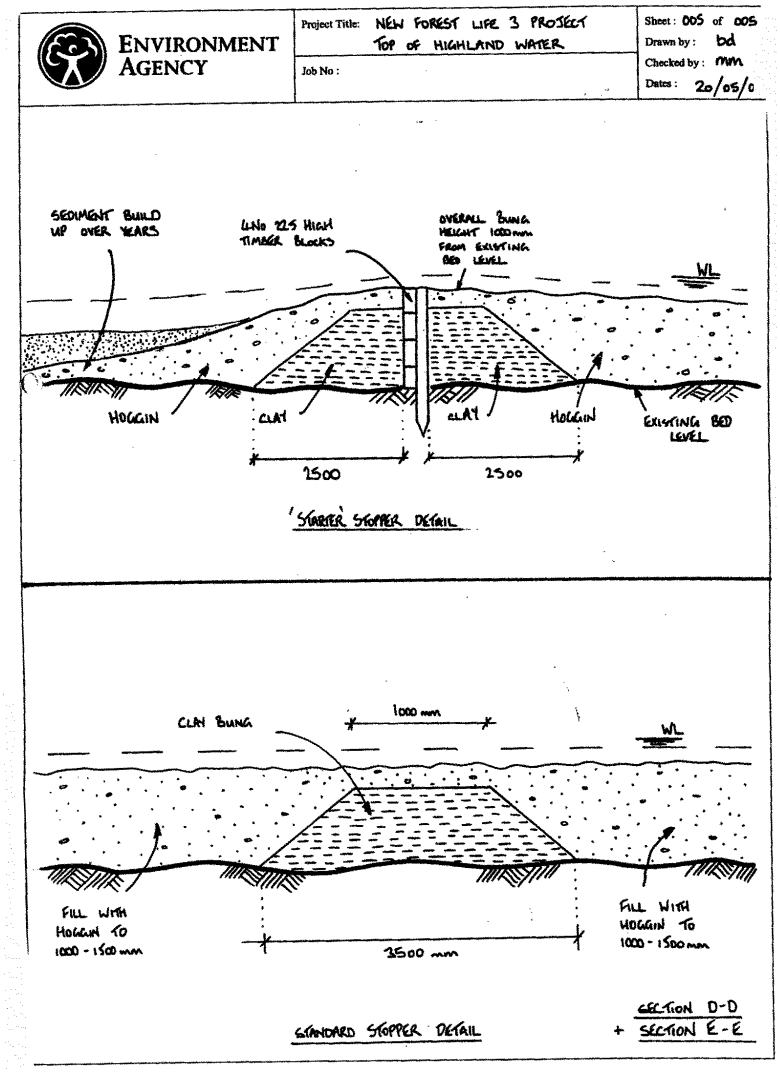
a)



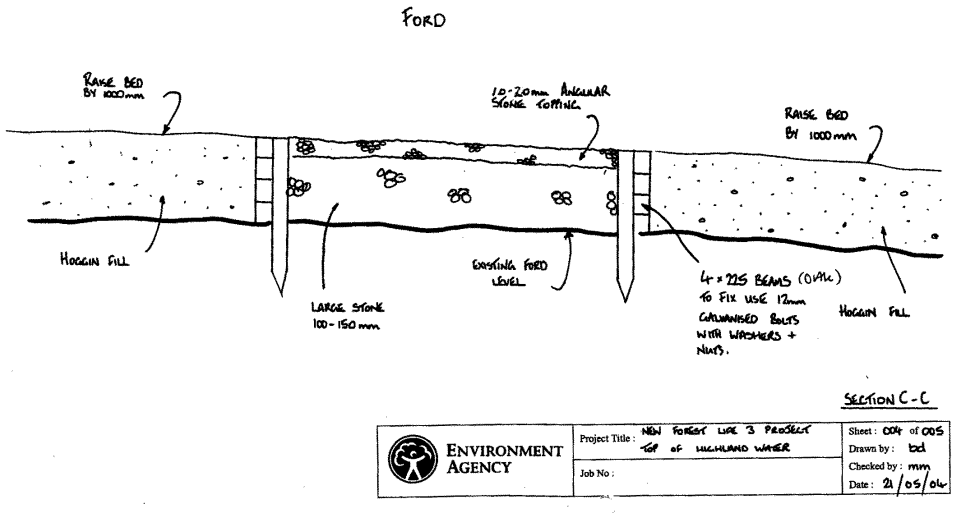
b)


FORD SECTION B-B
FORD
FORD
HIGHLAND WATER
WL
ANGULAR STONE 10-20mm
ANGULAR STONE 10-20mm
RAISE BED USING LARGE ANGULAR STONE 100-150 mm
ENVIRONMENT AGENCY
Project Title : NEW FOREST LIFE 3 PROJECT TOP OF HIGHLAND WATER - FORD
Job No :
Sheet : 003 of 005
Drawn by : bd
Checked by : mm
Date : 09/06/04

c)


ENVIRONMENT AGENCY
Project Title: NEW FOREST LIFE 3 PROJECT TOP OF HIGHLAND WATER
Job No :
Sheet : 005 of 005
Drawn by : bd
Checked by : mm
Dates : 20/05/0
SEDIMENT BUILD UP OVER YEARS
4No 225 HIGH TIMBER BLOCKS
OVERALL BUNG HEIGHT 1000mm FROM EXISTING BED LEVEL
WL
HOGGIN
CLAY
CLAY
HOGGIN
EXISTING BED LEVEL
2500
2500
'STARTER' STOPPER DETAIL
CLAY BUNG
1000 mm
WL
FILL WITH HOGGIN TO 1000 - 1500 mm
FILL WITH HOGGIN TO 1000 - 1500 mm
3500 mm
STANDARD STOPPER DETAIL
SECTION D-D + SECTION E-E

d)



Along Category A tracks designed to carry heavy timber lorries, concrete Irish Fords will need be constructed to allow vehicles safe access across the watercourse.

3.3.4 Conifer removal

Mature conifers will be removed in accordance with Forestry Commission good practice either using a mechanised harvester, manual chainsaw or skyline (see section 3.3.6 D for more detail).

3.3.5 Removal of non-natives

The majority of work regarding removal of non-natives will focus upon:

- Rhododendron
- Gaultheria

Removal of non-natives are generally carried out using a combination of mechanical clearance grubbing out the roots with an excavator and chemical spraying.

A) Rhododendron Clearance

Where ground conditions and access allow, large areas of rhododendron clearance are tackled using a tracked excavator or blecovator as shown below. The arisings are raked up burnt in situ. Stumps and any regrowth are then treated with Glyphosate and High Trees Mixture B to prevent regrowth two years/two growing season after cutting.

Where small patches of rhododendron persist or where areas are inaccessible for machinery they will be cut by hand to ground level and stems treated as above.

Rhododendron Clearance

B) Gaultheria Treatment

To date Gaultheria has been raked and the roots scraped out using a 360 excavator. In order to prevent regrowth the stumps are sprayed with Trichlopyr or Glyphosate (Glyphogen). Trial plots are on going to establish the most successful methods and spray regimes for removal.

3.3.6 A & O Woodlands

Various work is required to restore the condition of the A & O woodlands, notably:

- Removal of Exotics
- Bracken Treatment
- Pollarding
- Thinning of beech
- Holly Management

A) Removal of exotics

Treatment for Rhododendron & Gaultheria is the same as described above.

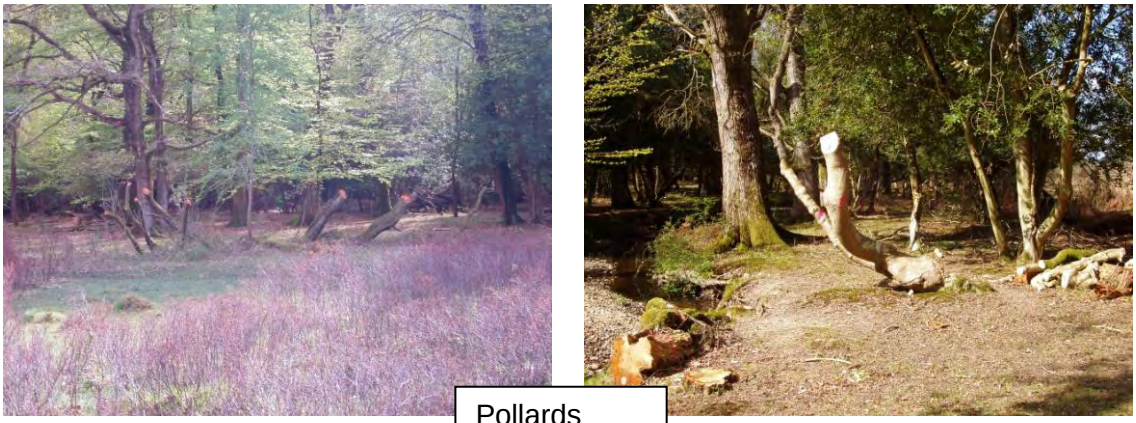
Individual exotic tree species for example Red Oak or Turkey Oak will be hand felled using chain saws and cut up and burnt on site. The stumps will be treated with Glyphosate to prevent re-growth. The timber from many of these exotic species is not of a quality that can be used commercially but occasionally can be used for firewood.

B) Bracken Treatment

For large areas bracken treatment is generally carried out using a tractor mounted spray. In smaller more intricate area back pack sprayers can be used. Asulam is the preferred spray for the treatment of bracken.

C) Pollarding of oak & beech

Pollarding is carried out by hand using a chain saw. Trees with trunks of <30cm diameter are cut at around shoulder height (around 1.5-1.8 metres). This is a traditional method of managing trees, akin to coppicing, which effectively prolongs their life and ensures continuity of habitat for many species dependant on woody timber.



Pollards

D) Thinning

Thinning will be carried out either by hand using chain saws or using a timber harvester or by whole tree harvesting using a sky line. The method chosen will depend upon the size and number of trees requiring extraction and/or ground conditions.

Where thinning is carried out by chain saw or harvester the brash is removed prior to extraction and left on site. If ground conditions allow a forwarder will be used to rake up the brash which is then burnt on site when weather conditions (including fire risk) allow.

Harvester at work

Forwarder in action

Skyline - Cranesmoor

E) Holly Management

Holly management is a seasonal activity which starts in late December, depending upon the severity of the winter, and continues to the end of February. It is beneficial because it opens up the ground to light and allows regeneration of rare lower plant communities (e.g. lichen) on adjacent oak and beech trees. Preserving the main holly stem protects any rare lichens that may be colonising the holly. Traditionally, cut holly also provides valuable winter fodder for grazing ponies. The general treatment methods for Holly is given in Table 3-7.

Table 3-7: Holly Treatment Methods

Holly Type	Treatment Method
Dense holly < 2m in height	♦ Do not cut ♦ Useful for protection for young saplings + not palatable to ponies
Dense holly > 2m in height but dominated by small diameter holly	♦ Cutting good for nature conservation purposes ♦ Best cut in blocks of 30-100m across, close to a path to allow ponies to find the cut holly. ♦ Do not cut holly at the edge of a wood to maintain shelter ♦ All holly <10cm (4”) diameter should be coppiced ♦ All holly >10cm(4”) diameter should be pollarded ♦ Hollies well colonised by lichens (i.e. those with extensive white

	splashes on the bark) should be favoured over those with bare bark (i.e with a uniform greyish brown bark) ♦ Where possible green growth should be left on new pollards ♦ Old pollards, especially those >0.3m in diameter should be repollarded using a safe platform or handtools or left uncut ♦ Occasional old Holly trees or Holly grown into the canopy can be left ♦ Only cut enough holly per work day in each site that can be eaten by the ponies before it goes off ♦ Leafy material should be cut up and spread ♦ If access allows, larger wood can be cut into cordwood lengths (4ft) and left stacked for removal in the summer
Older stands dominated by holly over 15cm (6") in diameter	♦ Only cut in series of small scattered sites or isolated specimens ♦ Do not cut at the edge of a wood or holm to maintain shelter ♦ Where alternatives are available Holly in old woods should be cut instead of Holly in the open in Holly holms ♦ Any small diameter holly can be coppiced, especially near mature trees ♦ Maiden hollies should be pollarded at shoulder height ♦ On multi-stemmed Holly only 1 or 2 stems should be pollarded ♦ Old pollards, especially those >0.3m in diameter should be repollarded using a safe platform or handtools or left uncut ♦ Occasional old Holly trees or Holly grown into the canopy can be left ♦ Only cut enough holly per work day in each site that can be eaten by the ponies before it goes off ♦ Leafy material should be cut up and spread ♦ If access allows, larger wood can be cut into cordwood lengths (4ft) and left stacked for removal in the summer

Source: Review of Holly Cutting in the New Forest 1997

Holly Prior to pollarding

Holly post pollarding – holly leaves have been eaten by ponies

3.3.7 Scrub Management

Scrub clearance is generally carried out using chainsaws or tractor-mounted flail. On most sites scrub management is selective, based on rotational cutting of small patches of scrub, particularly those patches which have become tall and straggly. Brushwood is gathered up and burnt on site, although the number of burn sites are restricted to as few as possible to

avoid damaging the ground surface. Any cut timber is stacked and left on site to dry before being sold and removed from site in the spring (if accessible). If the site is too wet to access material will be left in situ to rot.

On most sites scrub management will be by selective by cutting of small patches, potentially on a rotational basis so that some scrub is left.

Scrub Clearance as part of mire restoration– Stony Moors (Life 3)

Scrub clearance for lawn restoration – Dockens Water (Life 3)

3.3.8 Fence re-alignment

To date the use of deer exclosure plots has been used as standard silviculture practice in promoting the natural regeneration of native tree species in the New Forest. However, this method promotes tree colonisation with a relatively even aged stand structure. Timescales for regeneration within exclosure plots operate over far shorter time periods of between 5-10 years compared to natural regeneration in unfenced areas that is slow and inconspicuous. However, a review of woodland cover dating back to the 1860's shows that Riparian and

Bog woodland has been expanding steadily in key locations over the last 140 years (Sanderson, 2004).

As the key aim of habitat restoration is to regenerate near-natural bog and alluvial woodland, the use of deer exclosure plots has been considered less appropriate. Instead, fences have been realigned to open up parts of Inclosures to allow variable but significant grazing pressure and link the habitats back into the floodplain and Open Forest. This technique has a number of advantages:

- It avoids the situation in ungrazed sites where bracken dominates on drier areas preventing the colonisation by trees leaving the wetter areas to become densely colonised by trees. This results in a woodland structure atypical of the existing riparian woodlands.

- The early 19th century Oak plantations provide an existing resource for restoring high quality riparian woodland. However they lack the structural diversity typical of riparian woodland on the Open Forest, in particular a shrub layer comprising species such as Dogwood, Spindle, Crab Apple, Hazel, Wych Elm, Field Maple and Yew.

- Where the aim is to allow the development of riverine and bog woodland with minimal intervention, variable but significant grazing pressure is required to maintain structural and species diversity. Grazing is essential in controlling invasive species, such as Bracken, *Molinia* and Holly. Inter-linking the stands back into the open forest should allow stock to stray and graze these areas.

- Grazing by stock is essential in maintaining the traditional linkages between open mire and bog woodland. For example grazing maintains the quality of the open mire by reducing molinia dominance and preventing tree growth in all but the wettest areas.

- Intact patches of riverine and bog woodland still survive within some of the later Inclosures. These woodlands were “captured” during the formation of the Inclosures and have survived because of protection from clearance under the 1877 New Forest Act.

4 EXISTING ENVIRONMENT

4.1 INTRODUCTION

In order to identify the impacts and appropriate mitigation it is necessary to understand the existing environment prevailing in the New Forest SSSI and how it relates to the range of Pathfinder work sites distributed around the New Forest. In accordance with EIA regulations[1] the existing environmental conditions prevailing in the area will be considered in relation to:

- Human Beings
- Flora & Fauna
- Soil
- Water
- Air
- Climatic Factors
- Material Assets – Archaeology & Cultural Heritage
- Landscape

Data relating to the existing environment has been collated from published and unpublished reports and plans, data from statutory bodies and key stakeholder groups and from consultation with key individuals.

The location of the Pathfinder work sites are distributed randomly across the New Forest SSSI therefore for the purposes of describing the existing environment a generic description will be given relating to the New Forest as a whole or at catchment level, whichever is the more appropriate.

[1] Environmental Impact Assessment (Land Drainage Improvement Works) Regulations 1999 (SI1783)
Environmental Impact Assessment (Forestry) (England & Wales) Regulations 1999 (SI 2228)
Town & Country Planning (Environmental Impact Assessment (England & Wales) Regulations 1999 (SI 293)

4.2 HUMAN BEINGS

Key interests relating to human beings in New Forest SSSI and in the vicinity of the works are:

- Forestry & Land Management
- Recreational activities
- Commoning
- Settlements & infrastructure

4.2.1 Forestry & Land Management

The Forestry Commission currently manages 25,825 hectares of land which can be broken down as follows:

- Heathland & Grassland - 53%
- Inclosures – 33%
- Ancient & Ornamental Woodlands – 14%

The proposed Pathfinder work sites are distributed around all three cover types.

Heathland

Heathland covers 13,633 hectares of Crown Lands. The heathland can be broken into a number of vegetation types as shown in Figure 4.1. It is an important area for targeting SSSI restoration works containing 1,450 hectares of valley mire and 3,095 hectares of grassland communities, many of which have been damaged by past drainage works. The *Heathland Plan* sets out the policies and strategies for managing such areas, many of which are integral to wetland restoration and the maintenance and restoration of favourable habitat condition.

Inclosures

Inclosures cover 8,500 hectares and are areas designated for commercial forestry (Figure 4.2). The Statutory Inclosures were formed in the 18th and 19th centuries while the more recent Verderer's Inclosures were enclosed in the 1950's. A list of the different Inclosures and their date of origin is given in Appendix C. The Inclosure woodland provides the primary source of commercial timber within the New Forest from a combination of broadleaved and conifer woodland. The Inclosures are managed under the *Inclosure Plan* which amalgamates the prescriptions of 20 Forest Design Plans. The Ministers Mandate (Appendix D) combined with the Government's Forestry Strategy for England's woods and forests has prompted a change in management strategy with more emphasis being placed on:

- bio-diversity
- public access and recreation
- woodlands which contribute to local employment and support industries using wood products
- Recognition of archaeological and cultural features.

The future plan for land use cover within the Inclosures is shown in Figure 4.3. The transformation to a new mosaic of habitats is to be achieved through a series of management prescriptions linked to:

- Thinning
- Converting conifer plantations to broadleaf woodland
- Converting mixed woodlands to broadleaf
- Ride Management
- Proactive management of existing broadleaf and conifer woodland
- Natural regeneration
- Transformation to Pasture Woodland
- Transformation to Near-natural woodland
- Transformation to heathland and mire
- Access for Commoning Stock

The progression of works to restore the New Forest SSSI will be an important part of this transformation.

Ancient & Ornamental Woodlands

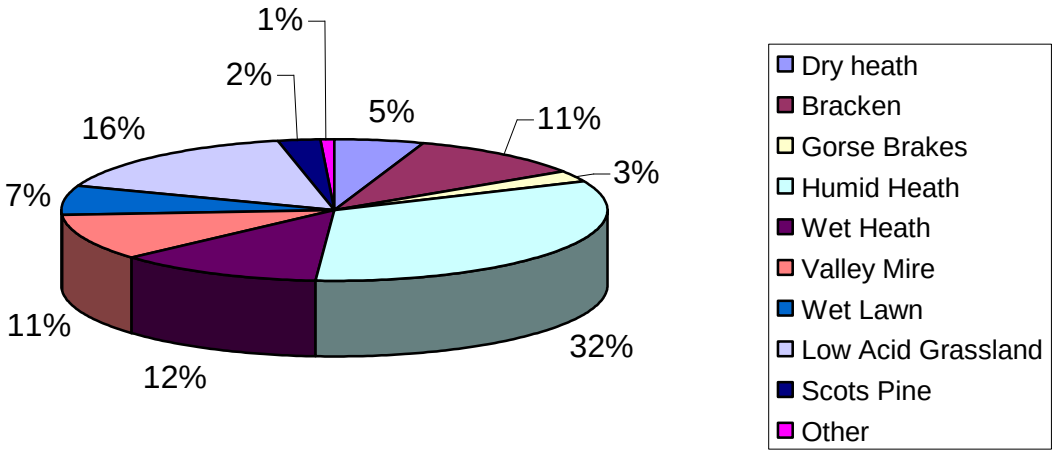
The Ancient & Ornamental (A&O) Woodlands, named under the 1877 New Forest Act, are the unenclosed ancient beech and oak woods some of which are direct descends from the original "wildwood". They also include limited areas of pre-inclosed woodlands fenced within the statutory Inclosures. The term also applies to secondary post-1850 regeneration woodland encroaching on the Open Forest and to riparian woods which line many of the Forest's rivers and streams. Some 3,692 hectares can be attributed to A & O woodland.

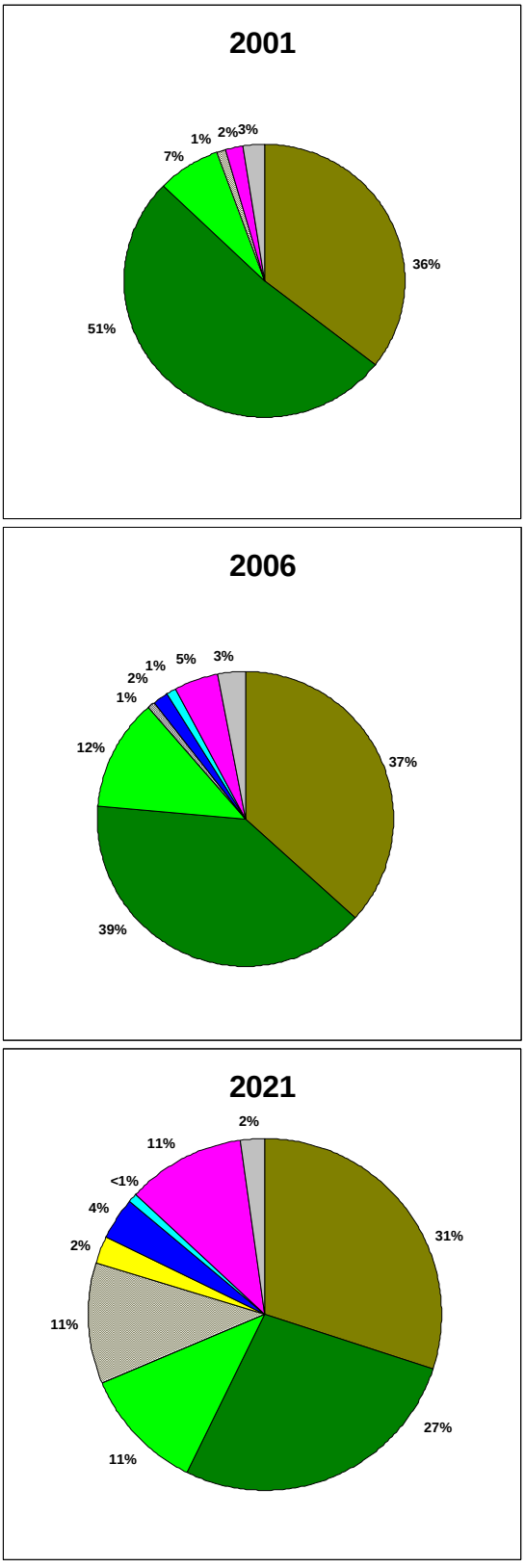
The management strategies and polices for the A & O woodlands are included in the *Plan for the Ancient and Ornamental Woodlands*.

Employment from forestry & land management

The Forestry Commission, based in at Queen's House in Lyndhurst is a key employer in the local area. Around 85 full time equivalent staff are directly employed by the Forestry Commission in the daily management, administrative and operational functional required to manage the Crown Lands. In addition a number of outside contractors, many of whom are from the local area, are employed to carry out key works.

Figure 4.1 Categories of Crown Land Heathlands (Hectares)





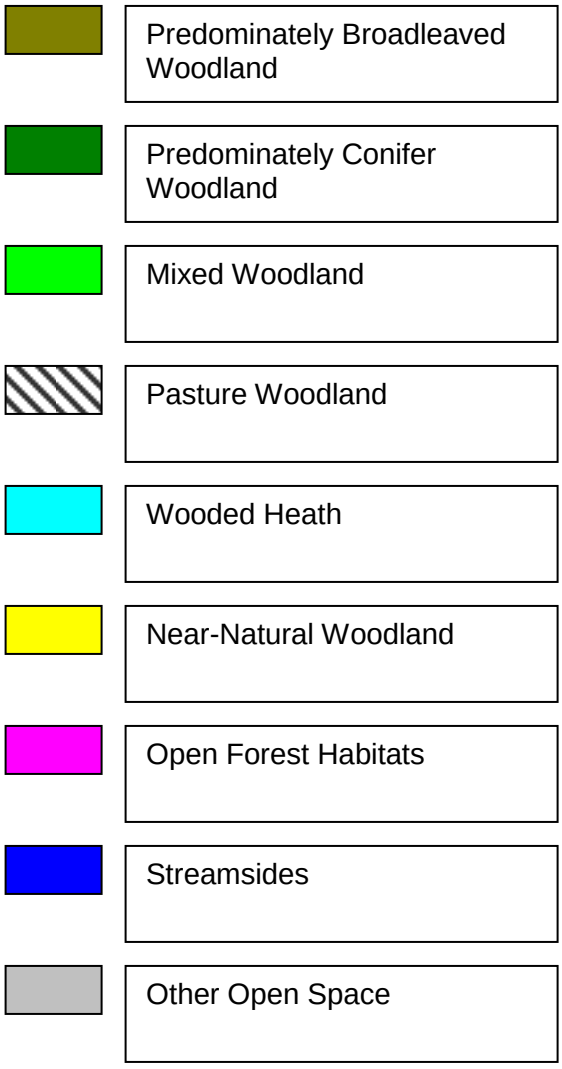


Figure 4.3
Change in Forest Cover

4.2.2 Recreational Activities

The New Forest and much of the SSSI provides an important recreational resource. In terms of visitor numbers, it has been estimated that at the current time (2006) around 15 million people visit the Forest each year of which 60-70% are made by local people from surrounding villages and conurbations.

Indeed the public has access to a large part of the New Forest SSSI on foot and on horseback since time immemorial. Today, recreation and access in the New Forest is overseen by a variety of organisations and individuals including the Forestry Commission, National Trust, Hampshire County Council, private estates and other individuals. In the future, the new National Park Authority is also likely to adopt a key strategic role. The main recreational uses within the New Forest SSSI are managed by the Forestry Commission and are shown in Table 4-1. The Forestry Commissions *Access and Recreation Plan* guides the policies and strategies for managing and developing recreational access.

The Forestry Commission operates a policy of permissive free access on foot to its land (where lease arrangements allow) and byelaws allow free access to the Crown Lands on horseback. Although many of the Pathfinder sites are “off the beaten track”, the majority sites can be accessed on foot and potentially on horseback should users wish to visit these areas.

Under the Law of Property Act 1925, most of the Crown Lands are exempt from the CROW Act but at least 800 hectares of Crown Freehold Inclosures will be dedicated for open access under the CROW Act. Cycling is restricted to a cycle network using tracks and roads around the Forest. Other activities are controlled by a licensing system. The Forestry Commission Ranger Team has a key role in educating the public about the Forest and its environment and regulating recreational activities.

The powers conferred to the Forestry Commission for the provision and management of recreation under the New Forest Acts are only exercisable with the agreement of the Verderers. However the two parties have not always been able to agree whether particular items legally require the agreement of the Verderers. Therefore a *Memorandum of Understanding Between the Forestry Commissioners and the Verderers of the New Forest (2002)* has been drawn up to clarify the position and is intended to be binding in honour only (Appendix E).

Part of the Crown Lands falling within the New Forest SSSI are leased for Golf Courses notably at Lyndhurst, Burley and Bramshaw.

Table 4-1: Recreational Use within the Forest Perambuation

Recreation Use	Level of Use	Current Management
Walking including dog walking	10 million visits per year	Forestry Commission operates policy of free access on foot
Horse riding	5000 horses & riders use New Forest	Forestry Commission byelaws allow free access on horseback within perambulation
Cycling	7% of visitors	Forestry Commission operates policy of encouraging cycle access on way marked tracks
Specialist recreation	1200 permits per year	Activities require permits from Forestry Commission with seasonal, locational and other restrictions applying. Activities include orienteering, model boats and aircraft, hunting, fishing, BBQ, Duke of Edinburgh awards, husky training, carriage driving
Other activities	900 permits per year	Activities require permits from Forestry Commission with seasonal, locational and other restrictions applying. Activities include filming, car access to inclosures, military training, bee keeping

Source: Forestry Commission

4.2.3 Commoning

Commoning is an ancient tradition which can be traced back to at least Saxon times. Grazing associated with Commoning has been essential in shaping and maintaining the habitats found in the Forest today. Rights of Common (Table 4-2) are attached to land or property and are conferred by its ownership or occupation. There are no limits to the numbers of stock attached to a property carrying commoning rights and it is a combination of market forces and available grazing which determines stocking levels. Indeed financial returns tend to be limited and it is tradition and 'a way of life' that has sustained commoning to date. There are currently 470 practising commoners, although around 1300 properties have commoning rights.

The management of Commoning is the responsibility of the Verderers Court. The Verderers comprise 5 elected and 5 appointed Verderers whose role it is to regulate the Rights of Common and development on the open Forest. Their role is guided by the New Forest Acts and byelaws. On 20th July 2005 the Verderers agreed a series of policies (Appendix F) to protect the "special qualities of the forest". In particular:

"The primary objective of the Verderers is to protect and administer the New Forest's unique agricultural commoning practices, to conserve its traditional landscape, wildlife and aesthetic character, including its flora and fauna, peacefulness, natural beauty and cultural heritage, and to safeguard a viable future for commoning upon which these depend."

The requirement to receive the consent of the Verderers is generally restricted to activities in the Open Forest (Heathland and A&O Woodland) and the Forestry Commission has a duty to consult and gain agreement with the Verderers in relation to activities or proposed developments on the Open Forest.

The Verderers are assisted by 5 Agisters who oversee commoning activities across the whole of the Forest. Each agister has his own geographical area of responsibility in which he oversees animal welfare, drifting and marking activities. The drifts are an important occasion when all the livestock on the Forest are rounded up. This allows branding of new foals, marking (the tail is trimmed to a particular pattern to indicate which area/Agister is assigned to) and removal of any animals that commoners want to sell or return to their holding. Checks can also be made that animals are legally depastured and 'marking fees' paid where appropriate.

Table 4-2: Commoning Rights

Rights	Definition
Common of pasture for commonable animals	Applies to ponies, cattle, donkeys, and mules. Applies to 65,000 acres of private enclosed land in and around the New Forest as calculated by the 1858 Register of Claims. Allows animals to graze freely on the Open Forest and certain Inclosures on Crown Lands and adjacent commons
Common of pasture for sheep	Confined to certain former monastic property in the S.E. of the Forest and to a few fields in the extreme NW. Right is not currently exercised.
Common of mast	Right to turn out pigs in the autumn to eat acorns. Mast season generally runs for 60 days.
Common of turbury and common of marl	No longer exercised
Estovers	Right to receive free firewood annually from the Forestry Commission. Less than 100 households benefit from this Right.

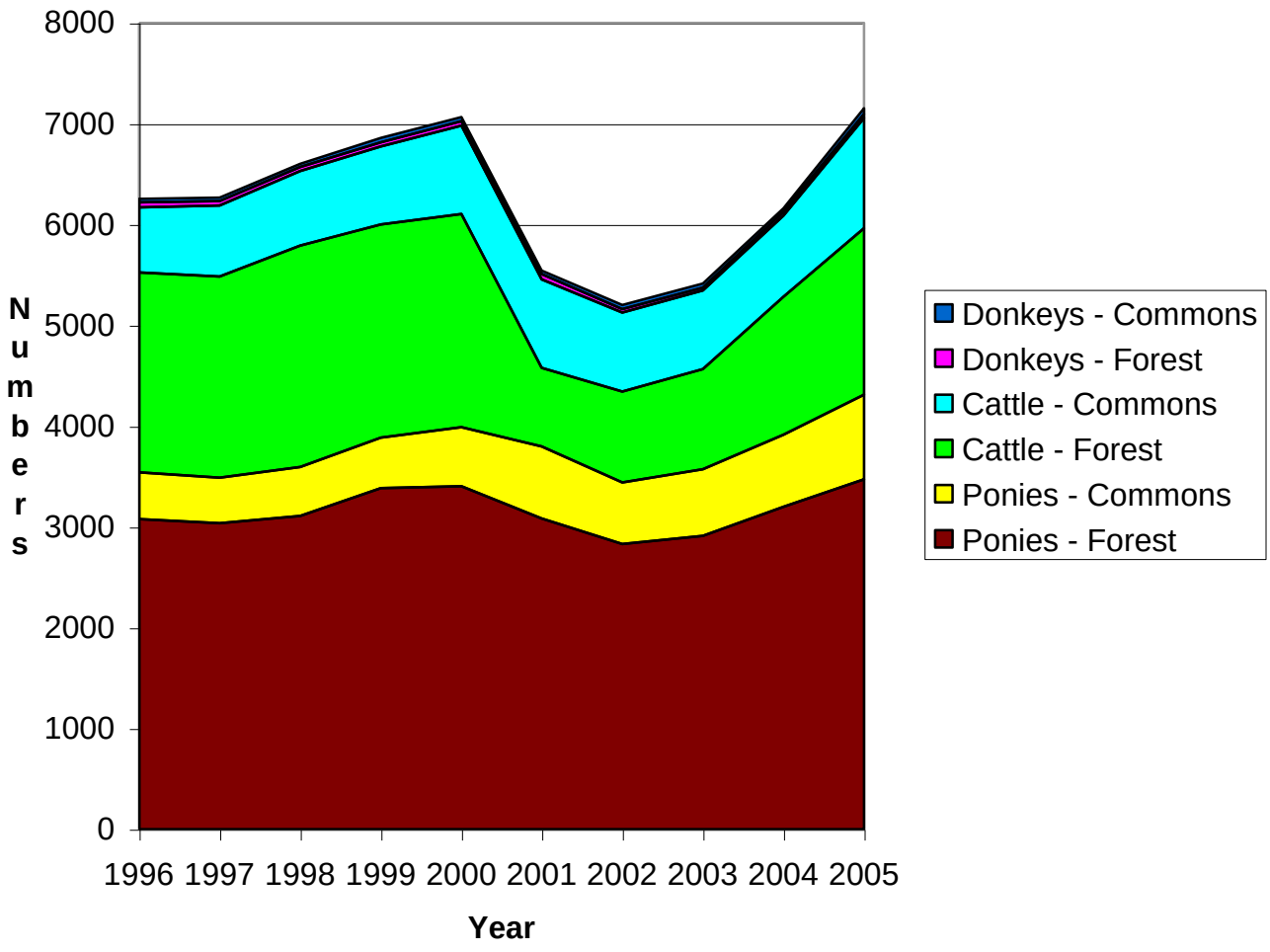
As well as the Crown Lands stock can graze freely on the Adjacent Commons. The Adjacent Commons are areas of common land, contiguous with or near the New Forest. They fall under the docrine of right of vicinage which states that where two commons adjoin, stock which may be depastured by right on one common, may wander freely between both. Therefore animals depastured on the Adjacent Commons can wander freely onto Crown Land.

Stock depastured on the Forest comprise ponies, cattle, donkeys and at certain times of the year Pigs can be turned out under the "Right of Mast" to eat the acorns which are

potentially toxic to horses and cattle. Ponies form the greatest proportion of stock on the Forest while cattle form a larger proportion on the Adjacent Commons as shown in Figure 4.4. The large dip in stock numbers in 2001 was due to the Foot and Mouth Crisis.

Commoning is under pressure from poor financial returns, soaring house prices which prevent the younger generation of commoners from acquiring property from which to continue their commoning rights and the high percentage of commoners who are of an age where they will inevitably give up commoning in the next 10-25 years.

Figure 4.4: Stock Numbers



4.2.4 Settlements & Infrastructure

Figure 4.5 shows the key settlements and infrastructure. It is estimated that the population contained within the National Park Boundary, which embraces the New Forest SSSI is around 34,400. The majority of the population is concentrated in towns and villages with the remaining found in isolated properties and hamlets scattered throughout the New Forest. Within the Forest itself the main population centres are focused in Lyndhurst, Brockenhurst and Burley.

The main infrastructure routes through the Forest are the A31, A35 and A337. A network of smaller B and C class roads criss-cross the Forest linking up the major networks. The London to Weymouth railway bisects the southern half of the Forest linking Bournemouth and Southampton.

A network of gravel tracks gives access to the Inclosures and the Open Forest and is used for maintenance access for forest operations and timber hauling (Category A tracks). Parts of this gravel track network combined with sections of public highway are used to provide cycle routes and public access throughout the Forest.

4.3 FLORA & FAUNA

4.3.1 Introduction

The New Forest is one of the most important sites for wildlife in the UK, and is widely recognised as being of exceptional importance for nature conservation on a European and International level. It supports a rich and complex mosaic of habitat types, formerly common in lowland Western Europe but now rare and fragmented. The main habitat types comprise extensive wet and dry heaths with their rich valley mires and associated wet and dry grassland, the ancient pasture and enclosed woodlands, the network of clean rivers and steams and frequent permanent and temporary ponds. Outstanding examples of thirteen habitats of European interest are represented together with two priority habitat types – bog woodland and riverine woodland.

The habitats support an exceptional variety of plants and animals including the richest moss and lichen flora in lowland Europe, scarce flowering plants and an outstanding community of invertebrates. It also supports important bird populations and one of the largest areas for breeding waders in southern England.

The quality and diversity of the habitats has arisen due to the historic and present day land use and management. Of particular importance is the pastoral economy based upon the Rights of Common (Refer to section 4.2.3). The commoners' stock, mainly comprising ponies and cattle have the right to roam freely over extensive areas. Over the years grazing patterns have helped to develop a unique ground flora and kept more aggressive species such as bracken and purple moor grass in check.

The importance of the New Forest SSSI is further enhanced by parts of the SSSI being designated a Special Area of Concervation (SAC), RAMSAR Site and Special Protection Area (SPA)

4.3.2 Habitats

The main habitat types which the proposed Pathfinder work sites embrace are:

- Pasture woodland
- Riverine Woodland
- Inclosure woodland
- Bog Woodland
- Mires
- Wet Grassland
- Wet Heath
- Dry Heath
- Temporary & Permanent Ponds
- Streams

The characteristics of these different habitat types are described below and their distribution shown on Figure 4.6.

4.3.2.1 Pasture Woodland

Pasture woodland comprises all woodland stands which depend upon grazing by livestock to maintain special interest features and include the Ancient & Ornamental Woodlands. Pasture woodland demonstrates great structural diversity ranging from saplings through to mature, senile, dead standing and fallen trees forming dense canopy to open stands with heathy or grassy lawns and glades. These woodlands support an exceptionally rich diversity of lichens, invertebrates, birds, funghi and bryophytes.

The following main community types make up Pasture Woodland:

- Type A (*Vaccinium-Dicranum majus* type)
- W15: Beech-Wavy hair-grass woodland
- W16: Oak species-Birch species- Wavy Hair-grass woodland
- Type B (*Agrostis capilleris – Thuidium type*)
- W14: Beech – Bramble Woodland (*Fagus sylvatica- Rubus fruticosus* Woodland)
- W11 Oak-Birch-Oxalis woodland (*Quercus petraea-Betula pubescens-Oxalis* woodland) and/or W10a Pendunculate Oak-Bracken-Bramble woodland (Quercus robur-Pteridium aquilinum-*Rubus fruticosus* woodland)
- Type C (*Agrostis capillaris – Thuidium Type, Oxalis – Anemone- Hyacinthoides variant*)
- Type D (*Agrostis stolonifera – Viola – Ranunculus ficaria* type)
- W8b: Ash-Field Maple- Dogs Mercury Woodland – Woodland Anemone sub-community (*Fraxinus excelsior- Acer campestre-Mercurialis perennis* woodland-*Anemone nemorosa* sub community)

Type A woodland (after Sanderson 1998) comprises pasture woodland with a ground flora characteristic of very acid soils, usually with Wineberry (*Vaccinium myrtillus)* and mixed bryophyte mats, typically with the moss *Dicranum majus*. Grasses tend to be absent or restricted to Wavy Hair Grass (*Deschampsia flexuosa)*.

W15 Beech- Wavy Hair Grass Woodland (*Quercus spp-Betula spp- Deschampsia flexuosa* woodland). This community is characterised by a mosaic of Beech (*Fagus sylvatica*) and Oak species (*Quercus spp*) with occasional Birch (*Betula pubescens*). The shub layer is often dominated by Holly (*Illex aquifolium*) with occasional Kneeholy (Ruscus aculeatus) and Woodbine (Lonicera periclymenum). The ground flora is typified by a range of moss species while grasses are restricted to Wavy Hair Grass (*Deschampsia flexuosa*) with occassional Soft grass (*Holcus mollis*) and Purple Moor Grass (*Molinia caerula*), the latter being heavily grazed. Associated herbs tend to be sparse but include Yellow Cow Wheat (*Melampyrum pratense*), Wood *Sorrel (Oxalis acetosella*) and Wineberry (*Vaccinium myrtillus*).

W16: Oak species-Birch species- Wavy Hair-grass woodland comprises recent stands (19th century) of oak, birch or pine planted on former heathland. Young beech are often present indicating a long-term succession to beech woods. The flora tends to be poor, often dominated by bracken.

Type B (*Agrostis capilleris – Thuidium* type) is pasture woodland with a ground flora characteristic of less acid soils but with spring vernal species absent.

W14: Beech – Bramble Woodland (*Fagus sylvatica- Rubus fruticosus* Woodland) is typically dominated by beech with older stands containing magnificent old pollards. Oak species are also frequent and may be as equally dominant as beech depending upon past management, regeneration and soil conditions. Occasional Yew and Rowan can be present. Holly is dominant in the shrub layer often casting dense shade. Due to poor soils and variable light conditions the field layer tends to be fairly impoverished with Tormentil (*Potentilla erecta*), Common Bent (*Agrostis capillaris*) prominent with occassional Heath Bedstraw (*Galium saxatile*), Common violet (*Viola riviniana*), Wood sorrel (*Oxalis acetosella*) and Field Cow Wheat *(Melampyrum arvense*). Moss mats tend to be prevalent but *Dicranum majus* is rare or absent.

W11 Oak-Birch-Oxalis woodland (*Quercus petraea-Betula pubescens-Oxalis* woodland) and/or W10a Pendunculate Oak-Bracken-Bramble *woodland (Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland). This community type is similar to W14 above but is characterised by oak over beech but its dominance is influenced by past management. Birch occurs frequently in canopy gaps and holly may be dominant in the understorey with Hawthorn and Hazel present. Although the ground flora is similar to W14 bracken can be more abundant.

Type C (Agrostis capillaris – Thuidium Type, Oxalis – Anemone- Hyacinthoides variant) pasture woodland is typified by a ground flora characteristic of less acid soils but with spring vernal species present. Moss mats are well developed but lack species typical of very acid soils

Type D (*Agrostis stolonifera – Viola – Ranunculus ficaria type*) is pasture woodland with herbs typical of base rich soils with poorer moss mats and can be divided into riverine woodland (described below) and woodland above the floodplain. It is characterised by the presence of herbs such as Wenwort (*Ranunculus ficaria*), Wood Marche (*Sanicula europaea*), Primrose (*Primula vulgaris*), Enchanter's Nightshade (*Circaea lutetiana*) and Cuckoo Pint/Lords and Ladies (*Arum maculatum*) on base-rich flushed soils.

W8b: Ash-Field Maple- Dogs Mercury Woodland – Woodland Anemone sub-community (*Fraxinus excelsior- Acer campestre-Mercurialis perennis woodland- Anemone nemorosa sub community*) lies on damp base rich soils above the floodplain and is highly rich in vascular plants compared to those communities found on acid soils. The canopy composition is varied but can be locally dominated by Ash, Pendunculate and Sessile Oak or Beech. The shrub layer often features Hazel, Hawthorn and Blackthorn. Holly may also be present. The ground flora is rich and dominated by spring vernals such as Bluebell (*Hyacinthoides non-scripta*) and Wood anemone (*Anemone nemorosa*).

4.3.2.2 Riverine Woodland

The New Forest is considered to be one of the best areas in the UK for Riverine Woodland. In the lowlands, intensive agriculture and flood control combined with woodland clearance have reduced this habitat type to small, fragmented examples. However the New Forest stands are relatively extensive and where not affected by localised stream canalisation, remain functionally intact. They also contain extensive old growth stands which are exceptionally rare in Europe.

New Forest Riverine Woodland comprises around 212 ha distributed along the floodplains or the stream and rivers. The woodland stands generally comprise occasional to abundant Alder (*Alnus glutinosa*) and frequent Ash (*Fraxinus excelsior*). The woodland is frequently inundated by seasonal floods, although some stands have become isolated from the floodplain due to past drainage and channel straightening. The rich alluvial soils produce a very rich woodland flora which is sometimes modified by grazing animals. Greater Tussock Sedge (*Carex paniculata*) is absent and Purple Moor Grass (*Molinia caerulea*) is very uncommon. In terms of the National Vegetation Classification (NVC), riverine woodland falls into:

- W8 – Ash-Maple-Dogs Mercury Woodland (Fraxinus excelsior-Acer Campestre-Mercurialis Woodland)

or

- W7 - Alder-Ash-Yellow Pimpernel woodland (Alnus glutinosa-Fraxinus excelsior-Lysimachia nemorum woodland.

It frequently lies somewhere between the two.

Within the W8 type woodland Alder is confined to the river banks, with Oak (*Quercus robur*) and Ash the dominant species within the woodland canopy with occasional Field Maple (*Acer campestre*). The tree crown can contain some ancient specimens. The shrub layer is very rich and includes species such as Hazel (*Corylus avellana*), Hawthorn (*Crataegus monogyna*), Dogwood (*Cornus sanguinea*), (*Euonymus europaeus*), Wild Privet (*Ligustrum vulgare*), and Blackthorn (*Prunus spinosa*), with frequent Holly (*Ilex aquifolium*), Bramble (*Rubus fruticosus*) and Rosa spp. The Holly trunks are noted hosts to rare lichen species.

The ground flora is also very rich and includes such species as Common Dog Violet (*Viola riviniana),* Wood Speedwell (*Veronica Montana*), Yellow Loosestrife (*Lysimachia vulgaris*), Lesser Celandine (*Ranunculus ficaria*), Wood spurge (*Euphorbia amygdaloides*), Cuckoo Flower (*Cardamine pratensis*) and the Lady Fern *Athyrium filix-femina*.

Within the W8 community Alder occurs in bigger stands especially in areas where there are peat accumulations in old channels and around springs. The Alder often shows signs of previous coppice management. Ash is also frequent with occasional Oak. The shrub layer is much poorer than in the drier floodplain woodland but Holly and Willow is usually present.

The ground flora is characterised by a prominence of wetland species including Remote Sedge (*Carex remota*), Yellow Pimpernel (*Lysimachia nemorum*), Bugle (*Ajuga reptans*), Marsh Valerian (*Valeriana dioica*), Water Mint (*Mentha aquatica*), Lady Fern (Athyrium filix-femina), Marsh Bedstraw (*Galium palustre*) and Marsh Marigold (*Caltha palustris*).

4.3.2.3 Bog Woodland

Bog woodland is a European priority habitat because it is considered to be rare and extremely restricted, particularly in north western European lowlands where mire drainage and reclamation has destroyed large areas of former bog woodland. In the UK

its total extent is estimated to be less than 1,000 ha. The New Forest is considered to be one of the best areas in the UK for Bog Woodland containing around 200-250 ha.

Bog Woodland is found on peat and contains a significant number of bog species in the ground flora. Bog woodland features two types of community - sallow carrs which are found in the acid headwaters and mires and alder carr which is found on richer soils in valleys on swampy ground. In terms of the NVC classification bog woodland communities can be divided into W4b and W5b as described below.

W4b – Downy Birch-Purple Moor-grass woodland – Soft-rush sub-community (*Betula pubescens-Molinia caerulea woodland – Juncus effuses* sub-community)

The W4b community is dominated by Downy Birch (*Betula pubescens*) with varying amounts of Grey Willow (*Salix cinerea*) and occasional Alder (*Alnus glutinosa*) over an open bog habitat. It is generally associated with the larger valley mires. Some communities are of very ancient origin but the growth is young and some is due to recent woodland expansion onto the valley mire. Alder is confined to ancient stands and is totally absent from stands that have colonised open mire in the last 130 years. The groundflora is typified by Sharp-flowered rush (*Juncus acutiflorus*) and Purple Moor Grass (*Molinia caerulea*), the latter controlled by grazing. The character of the community is often influenced by forest management regimes and grazing.

W5b – Alder-Tussock sedge Woodland- Yellow Loosestrife sub-community (*Alnus glutinosa-Carex paniculata woodland- Lysimchia vulgaris* sub-community)

The W5b community is characterised by an abundance of Alder. Occasional Grey Willow (*Salix cinerea*) and Downy Birch (*Betula pubescens*) occur in the shrub layer over shade tolerant Greater Tussock Sedge (*Carex paniculata*) tussocks. The ground flora is restricted by the amount of light that can penetrate the canopy, although the base-rich soils are capable of supporting a rich fen woodland flora including Purple Loosestrife (*Lysimachia vulgaris*), Water Mint (*Mentha aquatica*), Purple Loosestrife (*Lythrum salicaria*), Gipsywort (*Lycopus europaeus*), Lesser Spearwort (*Ranunculus flammula*), Remote sedge (*Carex remota*) and Royal Fern (*Osmunda regalis*).

4.3.2.4 Inclosure Woodland

Inclosure woodland is the woodland which is fenced off and not subject to grazing from Commoners' livestock. The Statutory Inclosures were formed on original heathland and ancient woodland in the 18th and 19th centuries and planted for commercial forestry. The stands demonstate a varying age structure based upon forestry rotation patterns. The soils and drainage patterns have been significantly modified such that semi-natural vegetation is not always discernable but certain areas do contain isolated stands of riverine and bog woodland as described above. Some of the older oak and beech plantations are beginning to develop a significant nature conservation interest particularly where they were planted on Ancient Woodland sites. The more recent Verderers Inclosures were planted with conifers in the 1950's and have a limited nature conservation interest except where remnants of mire and heath communities survive. However heathland restoration is on-going through the Forest Design Plan.

4.3.2.5 Mires

The New Forest mires cover an area of around 2020ha and occur as either seepage step mires or valley mires. They support a suite of communities including Valley Bogs, Bog Pools, Soakways, Poor Fen, Moorgrass Mires, Marl Flushes and Transition Mires. Although some areas have been damaged by drainage, most of the New Forest mire systems are still largely intact, and its extensive cover and transitions to other heathland communities is unparalleled in the UK. It is unlikely that such a variation in mire communities over such an extent in an intimate mosaic with other heathland exists in comparable form anywhere else in the Atlantic zone.

Valley mires can be found in the valley bottoms where low hydraulic gradients and impermeable subsoils prevail. Wide, shallow valleys can support extensive mires while the steeper valleys tend to support smaller more localised mires. Mires are characteristically acidic with a low nutrient status. However, in the Forest, the underlying geology strongly influences the water chemistry and nutrient status which are important in determining the distribution of different mire communities. The central flows of valley mires which receive water from the Headon Beds may be neutral or slightly alkaline, while those fed from sand and gravels are acidic. The mires become increasingly acidic and nutrient poor with distance from the central flow with communities changing from enriched fen and carr to Sphagnum bog towards the periphery.

Valley Bogs

Valley bogs are the most extensive form of mire community found in the Forest and occur both in valleys and seepage steps. The community is characteristic of NVC type M21a – Bog Asphodel-Bog Moss Valley Mire – White Beak-sedge Bog Moss sub-community. *Sphagnum papillosum* is dominant while other sphagnum moss species, for example *Sphagnum subnitens*, *S auriculatum*, *S. capillifolium* and *S. recurvum* are frequent. Other common species include Common Sundew (*Drosera rotundiflora*), Cross-leaved Heath *(Erica tetralix*), Bogbean (*Menyanthes trifoliate*), Perfoliate Pondweed (*Potamogeton polygonifoliuous*) and Bog Myrtle (*Myrica gale*) as well as a significant proportion of the British population of Bog Orchid (*Hammarbya paludosa).* The bryophyte flora is especially rich featuring many bog specialist liverworts.

Bog pools

Many of the larger mires support bog pools where low flows or stagnant water result in high acidity and very low nutrient levels. Carpets of Sphagnum moss are scattered with vascular plants such as Bog Bean (*Menythanthes trifoliate*), White beak-sedge (*Rhynchospora alba*) and Common Cotton Grass (*Eriophorum angustifolium*). Local species include Lesser Bladderwort (*Utricularia minor*), Great Sundew (*Drosera anglica)*, Brown Beak-sedge (*Rhynchospora fusca*) and Bog Sedge (*Carex limosa*). Bog pools are one of the few communities that do not rely on grazing for their survival.

Soakways

Soakway communities are associated with the natural drainage systems of pristine mires. The community is typified by NVC type M29 – Marsh St John's Wort – Bog pond weed soakway. Linear creeping mats of Marsh St John's Wort (*Hypericum elodes*) and Perfoliate Pondweed (*Potamogeton polygonifolius*) are highly distinctive and are often

accompanied by Lesser Spearwort (*Ranunculus flammula*) and Bulbous Rush (*Juncus bulbosus).* A range of other bog or poor fen plants can be found including *Sphagnum auriculatum*, Marsh Pennywort *Hydrocotyle vulgaris*, Bog Pimpernel (*Anagallis tenella*), Common Sundew (*Drosera rotundifolia*), Bog Aspodel (*Narthecium ossifragum*), Bottle Sedge (*Carex rostrata*), Lesser Water Plantain (*Baldellia ranunculoides*), Marsh Lousewort (*Pedicularis palustris*) and Marsh Bedstraw (*Galium palustre*). The diversity of species is dependent upon the degree of grazing and poaching and whether the soakway is permanently or seasonally wet.

Poor fen

Poor fen communities are composed of species which are tolerant of a higher nutrient status than the valley bog communities. The soils are consistently waterlogged and acidic with modest water flow. Poor fens are usually well grazed and provide commoners' stock with an early spring bite and essential grazing during times of drought. Like other mires, areas of poor fen have also been damaged by drainage.

The poor fen community is typified by M6di Star sedge-Bog moss mire-sharp flowered rush sub-community. Sphagnum recurvum is the dominant species while Sharp flowered rush (*Juncus acutiflorus*) is constant but controlled by grazing. Typical poor fen associates include Velvet Bent (*Agrostis canina*), Star Sedge (*Carex echinata*), Marsh Willow Herb (*Epilobium palustre*) and the mosses *Sphagnum palustre* and *Polytrichum commune*. In the New Forest, poor fens often host Marsh Violet (*Viola palustre*) and White Sedge (*Carex curta*).

Purple Moor-grass mires

Purple moor-grass mires have a high level of water movement. Low grazing levels produce ideal conditions for rapid Purple moor-grass (*Molinia caerulea)* growth and dominance. This species together with Bog Myrtle (*Myrica gale*) effectively suppress other less competitive species producing a rather floristically impoverished community. Other species include Sharp flowered rush (*Juncus acutiflorus*), Tormentil (*Potentilla erecta*) and Cross-Leaved Heath (*Erica tetralix*). In terms of NVC the community is representative of M25a: Purple moor-grass-Tormentil mire-Cross-leaved heath sub community.

Marl Flushes

The most striking Marl Flushes are found in seepage step mires on marl (lime rich clay) where the water is base rich (pH7.0 or higher) and allows tuffa to be deposited on mosses. However not all marl flushes are base rich enough to allow tuffa deposition. Stoney Moors provides a good example of a Marl Flush. In the New Forest, Marl Flushes are typified by the following communities:

Eleocharis quinquefolia-Drepanocladus revolvens mire which is a lowland form of NVC community M10a: *Carex dioica-Pinguicula vulgaris mire-Carex viridula oedocarpa-Juncus bulbosus* sub-community

Highly lime rich Marl Flushes (pH 7.0 or higher), depositing tuffa, with lime loving species prominent. The presence of Few Flowered Spike Rush (*Eleocharis quinquefolia*), the brown moss (*Cratoneuron commutatum*) and the abundance of the brown moss

Drepanocladus revolvens are diagnostic. Associated species include Carnation Sedge (*Carex panacea*), Tawny Sedge (*Carex hostaina*), Bog Pimpernel (*Anagallis tenella*), Devils Bit Scabious (*Succisa pratensis*) and Lousewort (*Pedicularis sylvatica*), Lesser Skullcap (*Scutellaria minor*) and Quaking Grass (*Briza media*). Purple moor grass (*Molinia*) is held in check by tight grazing. These marl flushes support a very rich flora including notable species such as Broad-leaved Cotton Grass (*Eriophorum latifolium*), Common Butterwort (*Pinguicula vulgaris*) and the bryophytes *Cratoneuron commutatum*, *Philonotis calcarea* and *Preissia quadrata*.

Eleocharis spp-Campylium stallatum mire-Narthecium ossifragum-Drosera rotundifolia sub-community which incorporates NVC Community M14 *Schoenus nigricans-Narthecium ossifragum mire*

This community is found in less enriched Mire Flushes (pH 6-6.5) which does not result in the deposition of tuffa. The only abundant moss is *Campylium stallatum*. Species characteristic of more acidic mires are evident including Bog Asphodel (*Narthecium ossifragum*) and Common Sundew (*Drosera rotundifolia*). Associated species include Sharp-flowered rush (*Juncus acutiflorus*), Carnation Sedge (*Carex panacea*) and Cross-Leaved Heath (*Erica tetralix*).

Transition Mires

Transition Mires occur on deep, waterlogged peat which are irrigated by base-rich water producing very wet swampy condition. They support brown mosses and tall sedges but Black Bog-rush (*Schoenus nigricans*) is never present. Transition mires are particularly notable for the rare species which they support including Slender Cotton Grass (*Eriophorum gracile*), Bog Sedge (*Carex limosa*), Slender Sedge (*C. lasiocarpa*), *Sphagnum contortum, S. teres, S. subsecundum*, Marsh Lousewort (Pedicularis *palustris*), Great Sundew (*Drosera anglica*), Lesser Bladderwort (*Utricularia minor*), *Pressia quadrata, Calliergon giganteum and Philonotis calcarea*. The communities are generally typified by NVC M9: Carex rostrata-Calliergon cuspidatum/giganteum mire, although a number of different stand types can be identified[2]

Mires and their importance for breeding waders

The New Forest mires (together with other New Forest open wetland habitats) are extremely important for breeding waders including snipe, curlew and redshank. The snipe population represents nearly 6% of the English population, the curlew population represents 15% of the southern England regional population and redshank 1.5% of southern England numbers, the majority of which breed at the coast. In addition the number of breeding lapwings are likely to be of regional significance.

The 2004 New Forest Breeding Waders Survey funded by Life 3 which repeated a similar survey conducted ten years previously (Tubbs & Tubbs, 1994) , confirmed that mires in particular remain extremely important for breeding snipe, curlews and redshanks, although their numbers have been reduced by 29%, 25% and 22-26% respectively. The number of breeding lapwing pairs have increased by 34-39%.

[2] For full description of community stand types refer to the New Forest SAC Management Plan

4.3.2.6 Wet grassland

The New Forest represents one of the best areas in the UK for wet grassland and is probably second only to culm grasslands for acid fen meadow. Wet grassland communities are of international importance for nature conservation and it is possible that the UK contains more of this habitat than survives in the rest of Europe, with the possible exception of the Republic of Ireland.

New Forest Wet grassland (or wet lawn) covers around 1063 hectares most of which is found along the non-wooded parts of floodplains. Flushed lawns are a characteristic feature of valley slopes and pasture woodland glades across the Forest. They comprise a suite of plant communities confined to impermeable or slowly impermeable clays, or permeable soils affected by high ground water levels. The lawns tend to be waterlogged in winter but dry out to some extent in summer.

The community types and distribution are strongly influenced by stocking regimes, soil moisture retention and soil fertility. Generally the swards are tightly grazed (<2cm) and are characterised by the presence of Velvet Bent (*Agrostis canina*) and sedges such as Carnation Sedge (*Carex panacea*), Common Sedge (*C. nigra*) and Common Yellow Sedge (*C. viridula oedocarpa*), along with species typical of wet grassland such as *Molinia caerulea*, Devil's Bit Scabious (*Succisa pratensis*), Creeping Willow (*Salix repens)* and Marsh Thistle (*Cirsium dissectum*). Extensive carpets of Bog Pimpernel (*Anagallis tenella)* are seasonally prominent. Where soil water retention is highest or around flushes Marsh Pennywort (*Hydrocotyle vulgaris*), *Juncus acutiflorus* and Marsh St. John's Wort (*Hypericum elodes*) are abundant. The more acidic sites support Sphagnum lawns and an increasing heathland element typified by Cross-Leaved Heath (*Erica tetralix)*.

4.3.2.7 Wet Heath

Wet heath communities cover 2,100 hectares of the New Forest. Wet heath occurs on nutrient poor mineral soils or very shallow peats that are at least seasonally waterlogged but may be dry on the surface in summer. The vegetation communities are strongly influenced by burning and grazing. Stands which are managed by burning and grazing have the highest biodiversity. The vegetation communities are typified by NVC communities M16a, M16b and M16c.

<u>M16a: Cross-leaved Heath – Sphagnum compactum wet heath-typical sub-community</u>

This community is the most extensive and accounts for nearly 50% of wet heath cover. It is generally found on the poorer soils in the northern half of the Forest and is characterised by the presence of Heather (*Calluna vulgaris*), Cross leaved Heath (*Erica tetralix*) and Purple Moor Grass (*Molinia caerula*) although the degree of dominance depends upon water levels and management regime. *Sphagnum compactum* is the dominant moss species. Lichens particularly the wet heath varieties such as *Cladonia strepilis* and *Pycnothelia papillosum* can be frequent. Typical vascular plants include Deer-grass *Trichophorum cespitosum* and Heath Rush (*Juncus squarrosus)*.

M16b: Cross-leaved heath-Sphagnum compactum wet heath-Devil's bit Scabious-Carnation Sedge sub-community

This community accounts for 40% of wet heath. It is more tussocky in nature due to the steady movement of surface water and tend to be much more herb rich than M16a due to the richer underlying soils. A rich herb community can usually be found between the Molinia tussocks including such species as Tormentil (*Potentilla erecta*), Devilsbit Scabious (*Succisa pratensis*), Heath Milkwort (*Polygala serpyllifolia*), Carnation Sedge (*Carex panacea*), Meadow Thistle (*Cirsium dissectum*) and Sawwort (*Serratula tinctoria*). Other notably species include Petty Whin (*Genista anglica*), Sneezewort (*Achillea ptarmica*) and Creeping Willow (*Salix* repens) and the nationally scarce Marsh Gentian (*Gentiana pneumonanthe*).

M16c: Cross-leaved Heath – Sphagnum compactum wet heath-White beak-sedge-Oblong-leaved Sundew sub-community

This heathland community type accounts for the remaining 10% of New Forest wet heaths. It is characterised by a reduced cover of Heather (*Calluna vulgaris*), Cross-leaved Heath (*Erica tetralix*), Purple Moor Grass (*Molinia caerula*) and an extensive cover of mosses including *Sphagnum compactum* and *Sphagnum tenellum*. Vascular plants include Deer-grass (*Trichophorum cespitosum*) and Heath Rush (*Juncus squarrosus*). Wetter hollows and runnels support Common Sundew (*Drosera rotundifolia)* and the rarer Oblong-leaved Sundew (*Drosera intermedia*) which is a particularly distinctive feature of this community. Bare peat tends to be colonised by the local *Rhynchospora fusca* and the club moss *Lycopodiella*.

4.3.2.8 Dry Heath

The New Forest dry heath communities comprise a structural mosaic of ericaceous vegetation with at least 10% young Heather *Calluna vulgaris* and between 20-50% maturing or old heather. Total cover of Heather is usually between 25-90%. Two main NVC communities can be found:

- H2 Heather-Dwarf Gorse Heath (Calluna vulgaris – Ulex minor)
- H3 Dwarf Gorse- Bristle Bent Heath (Ulex minor-Agrostis curtsii)

H3 differs from H2 by the presence of Bristle Bent possible due to higher levels of nutrients. In addition a further six sub community types can be found due to differing levels of soil moisture content and nutrient status through to those too wet to support Purple heather *(Erica cinerea*) but not wet enough to support *Sphagnum* and wet heath communities described above. Other species typical of dry heath include Cross-leaved heath (*Erica tetralix*) and Purple Moor grass (*Molinia caerula*), Bracken (*Pteridium aquilinum)* and Gorse *(Ulex europaeus*).

Heathland management through burning and grazing is essential to support dry heath communities. Pine, rhododendron and bracken control are also important activities. Dry heaths are also harvested to make the heather bales used for drain infill and sediment traps.

4.3.2.9 Temporary & Permanent Ponds

Temporary ponds (sometimes referred to as ephemeral ponds) are scattered throughout the New Forest and are typified by small water-filled depressions on poorly drained soils which dry out temporarily during the summer months and occasionally during very dry winters. These areas can support a unique assemblage of plants and invertebrates. Sanderson (1999) classified the communities of temporary ponds into five types:

- Spike-rush-Purple moor-grass community
- Lesser marshwort-Floating club-rush
- Creeping bent-Marsh foxtail- Knotweed community
- Floating sweet-grass community
- Pool edge assemblages

The communities of Permanent Ponds are complex but vary according to the water chemistry and have not been fully investigated or classified. Nutrient poor-acid/neutral ponds are often dominated by Shore-weed (*Litterellion uniflorae*) communities while richer acid/neutral ponds often have Common water-crowfoot (*Ranunculus peltatus*) as a dominant species. Further details of communities and individual species can be found in Sections 1.3.19 & 1.3.20 of the SAC Management Plan.

4.3.2.10 Streams

Although the Life 3 project has concentrated on restoring streams with the aim of improving the condition of riparian habitats, the streams themselves are unique. In fact the New Forest streams are a geographically isolated type with no equivalent in lowland England. As the streams flow downstream they become progressively less acidic and nutrient poor and consequently exhibit a unique vegetation succession from acid communities similar to those found in mountainous upland regions, through richer stream floras as they pass through open grassland and woodland communities, to more typical enriched neutral river plant communities in the lower reaches.

The ecology of the streams has been documented by Langford (1996) and the communities are described in detail in Section 1.3.20 the SAC Management Plan. The streams support a unique assemblage of macrophytes (higher plants) and important populations of macroinvertebrates and fish species as highlighed below.

Macrophytes

The New Forest streams support a unique assembly of plant species. Common species of macrophytes are listed in Table 3-13. Along many reaches of stream where the channel is shaded stands of macrophytes are generally non existent. However where open sections of channel have been channelised resulting in silt deposition downstream in slow flowing sections can be prolific.

Table 4-3: Macrophytes of New Forest Streams

Species	Common Name
Emergent/marginal plants	
Agrostis stolonifera	Creeping bent
Alisma plantago-aquatica	Water plantain
Apium nodiflorum	Fools watercress
Caltha palustris	Marsh marigold
Glyceria fluitans	Floating sweet grass
Hypericum elodes	Marsh St Johns Wort
Juncus acutifloris	Sharp flowered rush
Juncus bulbosus	Bulbous rush
Ludwigia palustris	Hampshire purslane
Mentha aquatica	Water mint
Menyanthes trioliata	Bogbean
Myosotis scorpioides	Water forget-me–not
Oenanthe crocata	Hemlock water dropwort
Ranunculus flammula	Lesser spearwort
Rorippa nasturtium-aquaticum	Summer watercress
Scophularis auriculata	Water betony
Sparganium erectum	Bur reed
Veronica beccabunga	Brooklime
Submerged/instream plants	
Callitriche hamulata	Water starwort
Callitriche platycarpa	Starwort
Callitiche stagnalis	Starwort
Elodea canadensis	Canadian pondweed
Potomageton polygonifolius	Bog pondweed
Ranunculus peltatus	Water crowfoot
Ranunculus omiophyllus	Water crowfoot

Source: Langford (1996)

Macroinvertebrates

Detailed studies have been carried out on the macroinvertebrate communities for the Life 3[3] Project for the Lymington River catchment (Black Water & Highland Water). The New Forest streams support a diverse population of macroinvertebrates including several rare species (Table 4-4). Community structure varies according to whether the channels are sinuous or channelised (Table 4-5). However, the conservation value of the macroinvertebrate fauna does not differ between sinuous channelised reaches. Of particular note is that some areas of marginal aquatic habitat were found to support extremely valuable invertebrate communities including the rare Mud Snail, *Lymnaea* (*Omphiscola) glabra*. The richest marginal habitats are those that flood on a regular basis including palaeomeanders and ephemeral leaf litter pools.

[3] Michael Thomas (July 2002) A Study of Habitat Structure and Macroinvertebrate Communities of the Highland Water and Black Water.

In addition to those listed there are numerous other significant invertebrate species associated with wetland habitats which are listed in Table 1.3.25.1 of the SAC Management Plan.

Table 4-4: Distribution of Rare Taxa in the Highland Water and Black

Species	CCI	Black Water				
		Main River		Marginal Habitat		
		Channelised	Sinuous	Composite	Paleomeander	Other
Lymnaea glabra	RDB2			P	O	
Agabus chalconatus	Notable			P	P	
Agabus melanarius	Notable				P	
Chaetarthria seminulum	Notable					P
Helochares punctatus	Notable			P	O	
Hydraena nigrita	Notable		P			
Hydraena rufipes	Notable	P				
Hydraena testacea	Notable				F	F
Hydrochus angustatus	Notable			O	O	O
Hydroporus ferrugineus	Notable				O	P
Hydroporus obsoletus	Notable					
Laccobius attratus	Notable			P		P
Paracymus scutellaris	Notable			P	P	O
Capnia bifrons	Regionally notable	F	F	P		
Niphargus aquilex	Regionally notable		F	O	P	O
Average CCI		18.76	22.31	18.20	29.48	21.71

Species	CCI	Highland Water		
		Main River		Marginal Habitat
		Channelised	Sinuous	Composite
Hydraena rufipes	Notable	O		
Hydroporus obsoletus	Notable			P
Capnia bifrons	Regionally notable	F	F	
Niphargus aquilex	Regionally notable	P		
Average CCI		15.69	14.61	14.28

F- Frequent	present in	>50%	of samples	SAMPLES TAKEN IN AUTUMN 2002
O-Occasional	present in	25-50%	of samples	SAMPLES TAKEN IN SPRING 2003
P-Present	present in	<25%	of samples	

Source: Michael Thomas (July 2003)

Table 4-5: Channel Structure Relationship between Significant Species

	Mean no. of individuals / sample		t-test
Black Water and Highland Water	Channelised	Sinuous	p=
Gammarus pulex	32.9	79.2	0.010
Paraleptophlebia submarginata	31.1	75.4	0.011
Pisidium sp.	0.1	0.6	0.020
Glossiphonia complanata	0.1	0.9	0.034
Lype reducta	0	0.8	0.037
Black Water			
Simuliidae	0.6	3.4	0.011
Rhithrogena semicolorata	2.4	8.6	0.035
Gammarus pulex	42.4	88.4	0.045
Highland Water			
Platambus maculatus	0.4	3.2	0.006
Silo pallipes	48.2	8	0.011
Paraleptphlebia submarginata	9.4	56.4	0.017
Habrophlebia fusca	0	1.6	0.035

I Source: Michael Thomas (July 2003)

4.3.3 Fauna

4.3.3.1 Mammals

The New Forest SSSI supports a wide range of mammals including a number of species of conservation concern (Table 4-6). In addition Fox, Badger, Deer (Fallow, Sitka, Red and a small population of Muntjac), Grey Squirel, Hedgehog, rabbits, Weasle, Stoat and a range of bats and rodents are common across the Forest. Of 17 species of native bat, 11 have been recorded in New Forest woodlands.

4.3.3.2 Birds

The New Forest habitats support an exceptionally rich and varied bird population including a number of conservation concern as list in Table 4-7. Of particular note are the Dartford Warbler, nightjar and woodlark all of which have breeding populations of European significant and the hen harrier which overwinters in numbers of European significance. The New Forest mires and wet heaths also supports valuable populations of breeding waders.

Table 4-6: Protected Mammal Species

Species	Habitat	Status
Mammals		
Dormouse	Woodland	IUCN LR/nt Annex II & IV Habitats Directive Schedule 5 Wildlife & Countryside Act British Mammal Red Data Book
Barbastelle bat	Trees or buildings	Annex IV Habitats Directive Schedule 5 Wildlife & Countryside Act British Mammal Red Data Book
Pipistrelle bat	Trees or buildings	Annex IV Habitats Directive
Grey long-eared bat	Trees or buildings	Schedule 5 Wildlife & Countryside Act
Brown long-eared bat	Trees or buildings	British Mammal Red Data Book
Seotine bat	Trees or buildings	Annex IV Habitats Directive
Noctule Bat	Wood Pasture	Schedule 5 Wildlife & Countryside Act
Bechstein's bat	Wood Pasture	IUCN VU Annex II & IV Habitats Directive Schedule 5 Wildlife & Countryside Act British Mammal Red Data Book
Daubenton's bat	Wood Pasture	Annex IV Habitats Directive Schedule 5 Wildlife & Countryside Act British Mammal Red Data Book
Brandt's	Wood Pasture	Annex IV Habitats Directive Schedule 5 Wildlife & Countryside Act British Mammal Red Data Book
Whiskered bat	Wood Pasture	Annex IV Habitats Directive Schedule 5 Wildlife & Countryside Act British Mammal Red Data Book
Natterer's bat	Wood Pasture	Annex IV Habitats Directive Schedule 5 Wildlife & Countryside Act British Mammal Red Data Book
Water vole	Streams & rivers	Schedule 5 Wildlife & Countryside Act British Mammal Red Data Book
Otter	Streams & rivers	Annex II & IV Habitats Directive Schedule 5 Wildlife & Countryside Act British Mammal Red Data Book

Source: SAC Management Plan

Table 4-7: Protected Bird Species

Species	Habitat	Status
Shelduck	Valley Mires/Permanent ponds	RSPB Amber list
Teal	Valley Mires/Permanent ponds	RSPB Amber list
Lapwing	Valley Mires/Wet grassland/Permanent & temporary ponds	RSPB Amber list
Curlew	Valley Mires/Wet grassland/Permanent & temporary ponds	RSPB Amber list
Redshank	Valley Mires/Wet grassland/Permanent & temporary ponds	RSPB Amber list
Snipe	Valley Mires/Wet grassland/Permanent & temporary ponds	RSPB Amber list
Kingfisher	Rivers & Streams	RSPB Amber list
Montagu's Harrier	Dry Heath (breeding)	W & C Act Schedule 1 RSPB Amber List
Hen Harrier	Dry Heath (roost)	W & C Act Schedule 1 RSPB Red List
Honey Buzzard	Woodland	W & C Act Schedule 1 RSPB Amber List
Kestrel	Woodland edge/heathland	RSPB Amber list
Hobby	Heathland	W & C Act Schedule 1
Merlin	Heathland	W & C Act Schedule 1 RSPB Red List
Ringed Plover	Dry grassland/bare stony ground	RSPB Amber List
Nightjar	Heathland mosaic	RSPB Red List
Wryneck	Woodland	W & C Act Schedule 1 RSPB Red List
Green woodpecker	Woodland/grassland mosaic	RSPB Amber List
Dunnock	Woodland edge/Scrub	RSPB Amber List
Skylark	Dry heath/grassland	RSPB Red List
Woodlark	Dry heath/Dry grassland	W & C Act Schedule 1 RSPB Red List
Nightingale	Woodland edge/dense scrub	RSPB Amber List
Redstart	Woodland	RSPB Amber List
Stonechat	Dry heath	RSPB Amber List
Song Thrush	Grassland	RSPB Red List
Grasshopper Warbler	Heathland	RSPB Amber List
Dartford warbler	Dry heath	W & C Act Schedule 1 RSPB Red List
Firecrest	Woodland	W & C Act Schedule 1 RSPB Amber List
Marsh Tit	Woodland	RSPB Amber List
Willow Tit	Woodland	RSPB Amber List
Starling	Woodland	RSPB Amber List
Goldfinch	Woodland/grassland	RSPB Amber List
Red-backed Shrike	Woodland edge	W & C Act Schedule 1 RSPB Red List
Hawfinch	Woodland	RSPB Amber List
Bullfinch	Woodland	RSPB Red List
Linnet	Heathland	RSPB Red List
Crossbill	Pine woodland	W & C Act Schedule 1

Source: SAC Management Plan

4.3.3.3 Invertebrates

The invertebrate population contains at least 276 species of conservation concern, present across a variety of habitats. A large number are saproxylic species depending upon a supply of fallen and standing deadwood. Others are found in ephemeral pools and damp spots on the floodplain, often in former meanders. Of 41 species of dragonflies and damselflies which breed in the UK, 27 are found in the New Forest including 5 of conservation concern (Table 4-8) including the Southern damselfly. A list of notable invertebrate species is given in Appendix G.

Table 4-8:Dragonflies and Damselflies of conservation concern

Species	Habitat	Status
Southern damselfly	Wet heaths, seepages and well vegetated streams and ditches	RDB 2 Annex II Habitats directive Schedule 5 W & C Act IUCN VU
Variable damselfly	Permanent ponds and ditches	Notable B
Small Red damselfly	Wet heaths, seepages, streams	Notable B
Scarce Blue-tailed damselfly	Wet heaths, seepages, streams	Notable B
Downy Emerald	Sheltered well vegetated permanent ponds and streams	Notable B

Of 56 species of butterfly present in the UK, 33 have been recorded in the New Forest since 1970. 17 species are of conservation concern (Table 4-9). Many woodland species are reported to be struggling but it is hoped that changes in forestry management through the Forest Design Plans, and to some extent through the Pathfinder works will create more favourable habitats for butterflies.

4.3.3.4 Amphibians & Reptiles

The ponds and streams support five native amphibians (Great crested newt, Palmate newt, Smooth newt, Common frog and Common toad). The Great crested newt is afforded protection as an Annex 2 species under the Habitats Directive. All six native reptile species are also found (Adder, Smooth snake, Grass snake, Slow worm, Common lizard, Sand lizard) but the smooth snake and sand lizard to confined to the heathland habitats.

Table 4-9: Butterfly Species of Conservation Concern

Species	Habitat	Status
Dingy Skipper	Heathland, grassland , woodland rides. Larvae feed on Birds foot trefoil *Lotus corniculatus*.	Local
Grizzled Skipper	Heathland, grassland , woodland rides. Larvae feed on *Potentilla spp*	Local
Green hairstreak	Scrub & woodland edge. Larvae feed on Gorse *Ulex or* Bramble *Rubus*	Local
White-letter hairstreak	Woodland edge with elm	Notable B
Silver-studded Blue	Heathland	Notable B UK BAP
Small Blue	Chalk grassland	Local UK BAP
Duke of Burgundy	Open woodland with Primula	Notable B UK BAP
White Admiral	Broadleaved woodland with Honeysuckle	Local
Purple Emperor	Broadleaved woodland with Willow spp.	Notable B UK BAP
Pearl Bordered Fritillary	Woodland edge & bracken with viola spp	Notable B UK BAP
Small Pearl Bordered Fritillary	Woodland edge with viola spp	Local UK BAP
High Brown Fritillary	Woodland edge with bracken	RDB 2 UK BAP
Dark Green Fritillary	Woodland edge with viola	Local
Silver-washed Fritillary	Broadleaved woodland with Common Violet *Viola riviniana*	Local
Marsh Fritillary	Wetgrassland with Devil's bit scabious *Succisa pratensis*	Notable B UK BAP
Heath Fritillary	Open woodland with Yellow Cow Wheat *Melampyrum pratense*	RDB 2 UK BAP
Grayling	Heathland.	Local

Source: New Forest SAC Plan 2001

4.3.4 Fisheries

The New Forest streams support healthy stocks of sea trout and brown trout and some stretches of the Lymington, Beaulieu and Hampshire Avon Tributaries are designated as Salmonid Fisheries under the EEC Freshwater Fisheries Directive. Sea trout are also found in the Avon Water, Dark Water and Bartley Water[4]. The sea trout populations are unique to each river and possibly even to individual tributaries. A number of coarse fish species are also present. The tidal flaps at the lower ends of the Avon Water, Bartley, Beaulieu and Lymington affect fish migrations to some extent.

The distribution of fish species throughout the Forest streams is shown in Table 4-10. Although not recorded in the 2001 survey (Gent, 2001), Brook Lamprey are found in the New Forest streams and were recorded during the surveys carried out in the Lymington for the Life 3 Project in 2003 (Wright, 2003). Lamprey and Bullhead are Annex 2 species

The fisheries surveys carried out in the upper Lymington catchment in 2003 prior to the Life 3 river restoration works in Highland and Black Water, recorded seven species of fish. Total numbers of fish caught were greater in sinuous stretches compared to channelised stretches. Greater numbers of Lamprey tended to be caught in sinuous sections, probably because lamprey prefer silty sediments, which are found in the slower flowing areas of the sinuous stretches. Conversely brown/sea trout and bullhead were caught in higher numbers in the channelised stretches. These species prefer gravel substrates and faster flows characteristic of channelised stretches. Brown/sea trout dominate the fish community both in terms of density and biomass in both sinuous and channelised reaches. Fish densities were also greater in sinuous stretches.

Eel are present in all of the Forest watercourses but have declined in recent years. The Environment Agency is researching options to improve elver passage into and up the forest Streams.

Generally, no fishing[5] has been permitted inside the Forest Perambulation since 1968. Outside the Perambulation the Beaulieu is fished by day ticket between the sea and Beaulieu and from Beaulieu to Northgate the river is fished by a syndicate. Four angling organisations fish the lower end of the Lymington. On the Avon Water some informal fishing takes place between the sea and Sway. The Beaulieu Estate operates a licensed net to catch sea trout at Beaulieu.

4.3.4.1 Protected fish species

The brook lamprey is an eel-like fish belonging to one of the most ancient groups of jawless fish. They spawn in March/April laying eggs in shallow depressions in suitable gravels (average size of less than 0.5cm), created by lifting away small stones with their suckers. After hatching the ammocoetes swim or drift downstream to areas of still water where they burrow in the silt. They can remain in their nursery habitat for up to seven years before metamorphosis and emergence as adults. The adults do not migrate far

[5] Fishing is permissible under the terms of certain hunting licences

and spawning grounds tend to be in close proximity to nursery grounds. Nor do adult brook lamprey feed and they die approximately one month after spawning.

Sea trout populations are unique to each river with adults returning to spawn in the river in which they originated. Adult sea trout enter the rivers from April/June and migrate up-stream to spawn in headwater gravel beds between October and January. Smolts move downstream for the marine migrations from March to June. The time for this migration is largely water temperature dependant.

Bullhead is the only freshwater cottid found in the UK. It is a small fish which rarely reaches 18cm in length. It is a unique and distinctive fish due to a combination of male parental care and nest building, production of sounds, potential for mate choice, high degree of territoriality and a body and eyes adapted to a flowing environment.

4.3.5 Nature Conservation Designations

As well as being a SSSI, parts of the site are also designated on an international level as a Special Area of Conservation (SPA) and RAMSAR Site. In addition the SSSI contains a number of local Hampshire Wildlife Trust local nature reserves notably Linwood, Long Aldermoor, Bagnum and Holmsley Gravel Pit

The status of the designations is described in Appendix H. In addition there are a number of Sites of Importance for Nature Conservation (SINCs) which are listed in Appendix I, together with the criteria for their selection.

Table 4-10: Fish Species in New Forest Streams

River	Location	Predominant Species	Minor Species
Avon Water	Efford SZ30863 93621	Brown trout, Sea trout, Dace	Flounder
	Wainsford SZ29870 95008	Brown trout, Sea trout, Roach	Minnows, Stoneloach
Lymington River	Bolderford Bridge SU 29101 04133	Brown trout, Chub, Gudgeon, Sea trout	Stoneloach, Bullhead, Eels
	Haywood Bridge SZ 31928 99306	Brown trout, Sea trout, Dace	Flounder, Chub, Pike
	Ivywood SU31482 02449	Brown trout, Pike, Gudgeon, Dace	Bullhead, Stoneloach, Minnows, Gudgeon
	Puttles Bridge SU 27039 02862	Brown trout, Chub, Pike	Bullheads, Stoneloach, Minnows
	Bratley Water SU2371406674	Brown trout, Eel	Bullhead, Minnow, Stoneloach
	Hart Hill SU2392706282	Brown trout, Eel	Minnow, Bullhead, Stoneloach, Lamprey
	Burley Lodge SU2408905317	Brown trout, Eel	Bullhead, Lamprey, Minnow
	Dog Kennel Bridge SU2409105061	Brown trout, Eel	Lamprey, Minnow, Stoneloach, Bullhead
	Blackwater Bridge SU2562904729	Brown trout, Chub, Eel	Bullhead, Minnow, Stoneloach, Lamprey
	Lucus Castle SU2463910232	Brown trout, Eel	Bullhead, Minnow, Stoneloach, Lamprey
	Highland Water Reptillary SU2736306830	Brown trout, Eel	Bullhead, Minnow, Stoneloach
	Poundhill Heath SU2845704804	Brown trout	Bullhead, Lamprey, Minnow, Stoneloach
	Withybed Bottom SU2476509884	Brown trout	Bullhead, Lamprey, Minnow
	Blackensford Lawn SU2308506958	Brown trout, Eel	Bullhead
	Blackensford Brook SU2374906571	Brown trout	Minnow, Bullhead, Stoneloach
	Dames Slough SU2498905020	Brown trout	Minnow, Bullhead, Lamprey, Stoneloach
	Warwickslade Bridge SU2562904729	Brown trout	Bullhead, Minnow, Stoneloach
	Fletchers Water SU2760204320	Brown trout, Eel, Elvers	Bullhead, Lamprey, Minnow, Stoneloach
	Rhinefield Enclosure SU26129 04593	Brown Trout	Bullhead, Minnows, Stoneloach, Lamprey
Beaulieu River	Ipley Bridge SZ 38042 06757	Brown trout, Sea trout	Minnows, Stickleback, Stoneloach, Bullheads
	Mately Bridge SU 33281 07178	Brown trout	Minnows, Stoneloach, Bullheads
	Shepton Bridge SU36956 04438	Brown trout	-
	Worts Gutter SU 36472 02753	Brown trout	-
Cadnam River	Ashurst Bridge SU 34382 12438	Brown trout	-
	Costicles DS site SU 31320 10410	Brown trout, Roach	-
	Costicles US site SU 31320 104108	Brown trout, Minnow	
Bartley Water	N/A		

Source: New Forest Fisheries Survey, 2001 & 2003

4.4 GEOLOGY, GEOMORPHOLOGY & SOILS

4.4.1 Geological History

The New Forest lies in the centre of a chalk syncline known as the Hampshire Basin. The majority of rocks are sedimentary, comprising soft clays and sands laid down during the Tertiary Period (60-40 million years ago) which give rise to the largely free-draining acidic soils of the New Forest. The rocks tilt gently southwards at an angle of $1^{o} – 2^{o}$ with the oldest exposed in the north and the youngest in the south. Some of the earliest deposits can be found in the basins of Cadnam and Hampshire Avon tributaries. Southward there are sequential exposures of Bagshot Sands, Bracklesham Beds, Barton Sands and Barton Clays. The key geological characteristics of these deposits are summarised in Table 4-11 and their distribution shown in more detail in Figure 4.7.

Tertiary deposits were laid down during the Eocene and Oligocene Epochs by shallow inshore seas, in deltas, estuaries and lagoons on the eastern and southern margins of a low-lying hinterland. At times the sea level rose to cover the whole area but only for short periods. During the Eocene the climate was that of tropical low lands such as those found in south–east Asia today. By Oligocene times a marked cooling had set in and the flora indicates subtropical swamp conditions like those of present day Florida.

During the Quaternary period the Tertiary deposits were overlain by superficial sheets of gravel and brickearth laid down by the extensive Solent River system. A distinctive feature of the Quaternary gravels is their angular flints. The Solent River system may have developed back in the Anglian Glaciation 450,000 years ago, but would have been disrupted during sea-level rise during inter-glacial periods. The climate varied greatly during this time with successive glacial and interglacial period with tundra conditions prevailing for much of the time. Large amounts of gravel would have been washed from more upland areas following snowmelt each year. Though much eroded, particularly in the north, extensive remnants of the gravel and Brickearth deposited by ancient river systems still survive as flat terraces. On the terraces below 80m there are extensive deposits of Brickearth up to 3m deep resting on top of gravel or infilling ancient drainage channels.

Rising sea levels over the last 10,000 years caused the river valleys to become drowned and infilled by fluvial deposited sands and gravels. More recent deposits of alluvium and peat can be found in the valleys and floodplains of the modern day river system.

Seven sites of special geological or physiographic interest are designated within the New Forest SSSI as highlighted in Table 4-12.

Table 4-11: Geological Characteristics

Period	Epoch*	Drift & SolidGeology	Key Characteristics	Avon Water	Lymington	Beaulieu	Bartley	Cadnam	Hampshire Avon Tributaries
Quaternary	Recent 25,000 year BP	Shingle	Found along coastal fringes of Lymington catchment including Hurst		✓				
		Alluvium	Found lining modern day river floodplains and valleys	✓	✓	✓	✓	✓	✓
		Peat		✓	✓	✓			
	Pleistocene 1 million years BP	Valley Gravel	Flinty in character with a complex mix of gravel, sand and clay.		✓		✓	✓	✓
		Brickearth	Unstratified mixture of fine-grained quartz sand or flint. Laid down as flood deposits along younger river terraces and may have a partially aeolian (windblown) origin	✓					
		Plateau Gravel	Composed almost exclusively of flint with some pebbles of sarsen (silicified sandstone) laid down on old river terraces	✓	✓	✓	✓	✓	✓
Tertiary	Oliogene 40 million year BP	Headon Beds	Healdon formations deposited in freshwater lagoon comprising shelly clays, silts and sands Lyndhurst member deposited in brackish or marine conditions and comprises more sandy sediments. Upper Headon formation is shelly sand.	✓	✓	✓			
	Eocene 60 million years	Barton Sands	Sands of marine origin	✓	✓	✓	✓		✓
		Barton Clay	Clay deposit laid down in deep water. Marks start of Barton group		✓	✓	✓	✓	
		Bracklesham Beds	Fossil rich deposits laid down in warm, marine and freshwater conditions.				✓	✓	✓
		Bagshot Beds	Sandy beds of coarse, porous material					✓	✓

* No record of Tertiary Pliocene or Miocene deposits

Table 4-12: Sites of Geological or Physiographic Interest

River Basin	Site of Special Geological or Physiographic Interest	Key Features of Interest
Hampshire Avon Tributaries	Studley Wood SU 227 158	Prolific Tertiary locality exposing the only complete exposure of the silty Huntingbridge Formation of the Bracklesham Group, remarkable for its molluscan fauna and the number of species limited to the formation. Numerous corals, scaphoda, bivalves and gastropods make it an outstanding Eocene locality of great interest in studies of Tertiary stratigraphy and palaeontology.
Hampshire Avon Tributaries	Cranes Moor SU 247 069	A large mire complex set in a shallow basin containing significant peat accumulations dating back to Devensian late glacial times. A key reference site for palynological and palaeoecological studies in southern England. Also unusual for the apparently rapid accumulations of peat in the Boreal Period and is thus important for the study of early immigration and expansion of flora in post-glacial times.
Hampshire Avon Tributaries	Wood Green Gravel Pit SU 172 170	The pit exposes gravel, deposited by the River Avon, rich in palaeolithic artefacts. Palaeolithic assemblages provide major evidence for the subdivision of the terrace sequence in the Solent Basin, where they are particularly important owing to a dearth of palaeontolgical sites. The site also has significant potential to elucidate the complex history of the River Avon gravels and the evolution of The Solent River.
Cadnam	Shepherd's Gutter SU 263 153	Locality renowned for its rich Tertiary marine faunas, known to geologists since the mid 19th C. Shows a section through the Selsey Formation of the Bracklesham Group, of Middle Eocene age, and includes several mollusc-rich horizons and one kind of *Nummulites* correlatable with the Isle of Wight and Bracklesham sections. A key locality for showing correlations between classic Eocene localities of the Hampshire Basin, and for its prolific molluscan faunas.
Lymington	Park Hill Inclosure SU 316 059	Only exposure in England outside the Isle of Wight to show upper middle Headon Beds. The occurrence of Cerithidea ventricosa and other mollusca in the Headon clays allows correlation with the type of sections of the Isle of Wight. The fauna of well-preserved shells and fish remains makes this one of the richest Tertiary faunal localities on the mainland. Also an important site for its palaeontology and for correlations within the Tertiary Hampshire Basin.
Lymington	Mark Ash Wood SU 247 069	A valley mire complex of considerable importance for palynological and palaeoecological studies. Peat growth at the site dates from the early part of the Devensian late-glacial to the sub-Atlantic Period. Also contains older post-glacial peats in the New Forest and is exceptional for high accumulation rates during late-glacial times. Macrofossil and pollen analyses have yielded some of early British post-glacial records of bryophytes. Site also important for tracing early post-glacial immigration and expansion of flora in post-glacial times.
Lymington	Highland Water SU 272 073 SU 239 123	Unique area demonstrating a combination of low management and low human impact on fluvial processes. The hydrological and fluvial characteristics of Highland Water are typical of those that formerly occurred in much of southern England. The site provides valuable opportunity to study both the role and influence of vegetation in hydrological and fluvial processes as well as the effect of debris dams.

4.4.2 Geomorphology

The New Forest can be viewed as a plateau dipping gently from north to south. The steeper western escarpment is flanked by the broad Avon Valley while the lower valley of the River Test and Southampton Water provide a boundary to the to east. The gently sloping southern flank is bounded by the Solent. The smaller tributaries and streams draining the Forest have eroded down through the plateau to create gently sloping valleys between flat-topped hills giving rise to an undulating topography (Figure 4.8). The highest point in the Forest is around 125m OD to the north of the Forest along the watershed between basin of the Cadnam and Hampshire Avon Tributaries.

The main Forest watershed runs approximately north to south and separates the Hampshire Avon tributaries from the other five main river basins. The Blackwater and Cadnam Rivers drain east into the lower end of the River Test and Southampton Water respectively. The Lymington, Avon Water and Beaulieu all drain in a southeasterly direction to the Solent.

The Hampshire Avon tributaries have cut deeply incised U-shaped valleys, which are separated by long, narrow, gravel-capped ridges. Their short, steep profiles have evolved in response to recurrent down cutting by the River Avon whose course has remained reasonably stable through recent geological history.

In contrast, the drainage networks east of the main watershed seem to have evolved in response to a retreating river or shoreline. The Cadnam, Bartley and Lymington rivers all have their sources close to the watershed in the north east of the forest around the 90m OD. The Beaulieu rivers rises at a lower level (46m OD) toward the middle of the Forest at Lyndhurst while the Avon Water rises to the south of Burley (50m OD).

4.4.3 Soils

The soils of the New Forest have been mapped by the Soil Survey of England and Wales at 1:250,000 scale and are described in *Bulletin No. 15 Soils and their use in South-East England.* Ten different soil associations can be found across the river basins as summarised in Table 4-13. More detailed soil surveys have been carried out for the Inclosures (Pyatt 1964) as shown in Figure 4.9.

The majority of soils are seasonally waterlogged as indicated by the soil wetness class. However, drainage in many parts of the Forest has improved the drainage characteristics. The humose, waterlogged surfaces of the many soils are highly susceptible to poaching and structural damage during the winter months.

Table 4-13: Soil Characteristics

Soil Association	Characteristics	Soil Wetness Class *	Avon Water	Lymington River	Beaulieu River	Bartley Water	Cadnam River	Hampshire Avon Tributaries
Wickam 3 (711g) (42m OD)	Typical stagnogley soil. Fine loamy or fine silty drift over clayey passing to slowly permeable clay or mudstone. During heavy winter rain excess water is disposed of by lateral flow. In New Forest soils often have thin humose surface horizons and poach easily Waterlogged for long periods during winter but moderately droughty during summer	III or IV	✓	✓	✓	✓	✓	✓
Bolderwood (643c) (On ridges above 43m OD)	Very acid Stagnogley-podzols. Occur where river terrace drift and Plateau Gravel cover Tertiary clays, loams and sands. Coarse loamy, flinty, horizons over clayey stoneless drift. Subsoil pans and other slowly permeable layers impede vertical water movement causing seasonal waterlogging. Excess winter rain is absorbed slowly and ponds on surface but there is little run-off. Surfaces are wet and muddy in winter and humose or peaty topsoils are slippery and vulnerable to erosion.	III or IV	✓	✓	✓			✓
Holidays Hill (643a) 25m OD	Stagnogley-podzols with permeable sandy surface horizons passing to loamy and slowly permeable layers below. Wet at the surface for long periods in winter with thin humose or peaty surface horizons developing under heathland. At risk of poaching & compaction in winter.	Wetness class IV		✓	✓		✓	✓
Shirrell Heath 1 (631c) 95m OD	Very acid, sandy-humo-ferric podzols. Permeable and well drained and droughty in summer	Wetness Class I						✓
Southampton (634) 47m OD	Palao-argillic podzol with very stoney, very acid, sandy soils	-						✓
Bursledon (572j) 40m OD	Stagnogleyic argillic brown earths with fine loamy horizons passing to clay and sand. Seasonally waterlogged	III or IV		✓				✓
Hurst (841b) 20mOD	Typical argillic gley soils with coarse loamy horizons over non-calcareous gravelly deposits, developed in river terrace gravels. Waterlogged by ground water for much of the winter with short periods of winter flooding. Can be droughty in summer.	III or IV		✓	✓		✓	✓
Shabbington (841d)	Argillic gleys developed in loamy drift which vary in stoniness and commonly rest on bedded sandy or gravelly material at depth. Found in river terrace drift. Tend to be affected by high water levels and are seasonally waterlogged.	III or IV	✓					
Isleham 1 (861a) (121m OD)	Typical humic-sandy gley soils developed in permeable, sandy, sometimes stoney drift found in valley bottoms and depressions. Perennially waterlogged and support much boggy vegetation.	V						✓
Efford (571s)	Argillic brown earths with well drained brown fine loamy soils associated with river or marine terraces where drift overlies non-calcareous gravel.	I	✓	✓	✓			✓

(Source: Jarvis et al 1984)

* For description of Soil Wetness Class refer to Appendix K

4.5 WATER

The Pathfinder works will take place within the six main river basins within the New Forest, notably the:

- Lymington River
- Beaulieu River
- Avon Water
- Bartley Water
- Cadnham River
- Hampshire Avon Tributaries

In addition a couple of sites are located in Dark Water catchment,

The six main river basins are drained by a complex network of rivers, streams and drains as shown in Figure 4.10 and Table 4-14. Although many have different local names, for the purposes of this EIA they are referred to by the names cited on the New Forest 1:25,000 Ordnance Survey map.

A significant amount of data exists for the Lymington Catchment as this has been studied for many years by Southampton University and has been subject to specialist studies for the Life 3 Project[6]. However, the majority of watercourses within the New Forest are not classified as Main River and data is limited for many of the streams. The locations of Monitoring and Gauging Stations are also shown in Figure 4.10.

Since the 1870's, well over half the total length of main streams and first order tributaries have been modified to some extent by drainage schemes to improve areas for forestry or grazing. For example, 78% of surveyed channel in the Black Water and 44% along the Highland Water have been modified in the past. Even so, the rivers and stream still represent an excellent example of a relatively undisturbed lowland river system.

4.5.1 The River Basins

4.5.1.1 Lymington River Basin

The Lymington River Basin is the largest basin (127km^2) in the New Forest and comprises a dense network of steams and tributaries draining a highly wooded catchment. The highest tributaries (Highland Water & Bratley Water) rise at 100- 110m OD around Ocknell Inclosure just to the north of the A31. Highland Water is joined by Bagshot Gutter at SU263 084 before continuing south east via Millyford Bridge and the A35 (SU 276066) to join the main River Lymington at Bolderford Bridge (SU291041)

Bratley Water rises at 98m OD from spring lines around the valley occupied by Slufters Inclosure, to the north of the A31. It flows south through North Oakley Inclosure where it

[6] Geodata Reports

becomes the Blackensford Brook (SU237066) and on through Anderwood Inclosure to meet the Black Water just upstream from Dog Kennel Bridge (SU 241052).

The small network of tributaries feeding the Warwickslade Cutting rise around 75-55mOD in the area of Mark Ash Wood, Wooson's Hill Inclosure and Holidays Hill Inclosure to the north of Bolderwood Arboretum Ornamental Drive. The Warwickslade Cutting joins Highland Water at SU282051.

The Black Water rises around 68m OD to the outside edge of South Oakley Inclosure and flows south-east via Dog Kennel Bridge and Dames Slough Inclosure to pass under the A35 at Blackwater Bridge (SU244047) and Rhinefield Ornamental Drive before flowing through a long, straightened reach known as Fletchers Water. Fletchers Water joins Highland Water at SU 287044

Mill Lawn Brook rises at 90m OD from Ridley Bottom just to the south of the A31. It is fed by additional tributaries rising from Harvest Slade Bottom before flowing through Burley and then eastward via Markway Bridge (SU 250039) and Puttles Bridge (SU278 028) where it becomes known as Ober Water. The Silver Stream draining Redhill Bog also enters Ober Water at Puttles Bridge. The Ober Water continues to flow eastwards to the north of Brockenhurst where it joins the Lymington River at Bolderford Bridge (SU 291 041). The Weir Stream rises from White Moor at SU275019 and flows eastwards through Brockenhurst before entering the Lymington River at SU 304031.

From Bolderford Bridge the Lymington River is classified as main river[7]. It continues to meander southwards through woods and agricultural land before passing to the east side of Lymington where it enters the sea. The normal tidal limit extends to Walhampton (SZ329963). Tidal flaps control the flow at its outfall.

4.5.1.2 Beaulieu River

The Beaulieu River has its source at Pikeshill on the north side of Lyndhurst rising at 55m OD. It flows south-eastwards draining predominately open heath and woodland except where it flows through the agricultural land holdings of Decoy Pond Farm and Ipley Manor. The river leaves the perambulation at North Gate (SU384047) from where it meanders southwards through fields and woodland before reaching its tidal limits at Beaulieu (SU 387 024) where tidal flaps control the flow. It then follows a long tidal estuary for approximately 8km to reach the sea.

Shepton Water rises at 14mOD at Penny Moor and flows eastwards via Shepton Bridge to join the main river at North Lane (SU 384044). Worts Gutter rises at 41m OD at the edge of Stockley Inclosure and flows eastward where it becomes the much straightened Penerley Water. The Shepton Water and Penerley Water converge at SU 375046.

A number of shorter un-named tributaries also join the Beaulieu throughout its length.

[7] Main river classification mean that the Environment Agency has permissive powers to maintain the drainage capacity of the channel and may also carry out works to limit the risk of flood from the river subject to technical, environmental and economic feasibility and to the availability of funding.

4.5.1.3 Bartley Water

Bartley Water is one of the smallest river basins. It is fed by two main tributaries – The Mill Steam and Fleet Water. The Millstream rises at 99m OD in Ringwood Ford Bottom and drains south-eastwards via Leominstead Pond before turning north east to converge with Bartley Water at SU305105. Fleet Water rises near Stoney Cross at around 109M OD and flows south-eastwards through wooded and agricultural areas before passing through Mill Pond and converging with the Mill Steam at SU 298102.

Outside the New Forest perambulation the Bartley Water is joined by a series of un-named tributaries which drain a large part of its catchment south of the M27. This part of the catchment is semi - rural interspersed with fields and settlements. The Bartley Water passes through the National Park Boundary to flow through Totton and enter the sea at the upper end of Southampton Water.

4.5.1.4 Cadnam

The Cadnam is another small river basin draining the north-eastern corner of the Forest. The Cadnam River rises to the north-east of Minstead around 55m OD and drains north and north eastwards via a dammed lake at Paultons Park and Ower Bridge (SU 326167) to join the River Blackwater at SU 338171.

4.5.1.5 Avon Water

The Avon Water basin is a small basin draining the south-west edge of the Forest. It rises within the southern confines of Burley and flows eastwards where it drains Holmsley Bog. The river continues its journey following the edge of Wootton Coppice Inclosure and Broadley Inclosure where it appears to have been significantly straightened before passing the perambulation boundary at SZ 266984. From this point it flows through farmland via Sway Lakes and passes to the western side of Lymington before entering the Solent at Keyhaven. Tidal Flaps control its outfall to the sea.

4.5.1.6 Hampshire Avon Tributaries

The Hampshire Avon tributaries draining the Forest comprise a south-eastern sub-basin of the main Hampshire Avon. The tributaries comprise a series of small streams draining the western side of the Forest.

The most northerly stream is un-named but drains Deadman Bottom, Millerford Bottom and Hale Purlieu.

Black Gutter rises around 108m OD. Where the stream bends southwards at Stone Quarry Bottom it becomes the Ditchend Brook. It enters the River Avon at SU 148134.

The Latchmoor Brook rises at 115m OD at Picket Corner and flows south westwards through Islands Thorns Inclosure, Amberwood Inclosure and Alderhill Inclosure before entering the

Open Forest. Around Ogdens the stream is known as the Huckles Brook where it flows through farmland before entering the River Avon at SU149106

The Dockens Water rises around Fritham at 115m OD and flows south westwards through the Open Forest passing close to the northern edge of Holly Hatch Inclosure, Broomy Inclosure and Linwood. After passing through the National Park Boundary it flows between gravel pits and Blashford Lakes Nature Reserve before joining the River Avon at SU 144064. Hampshire Wildlife Trust has carried out some restoration work on the Dockens Water where it flows through Blashford Lakes Nature Reserve.

Linford Brook rises at 94m OD and flows through Milkham Inclosure, Roe Inclosure, Greenford Bottom and Linford Bottom. After the perambulation boundary it passes through farmland and between gravel pits to the north of Ringwood before entering the River Avon at SU147058.
Smaller un-named tributaries drain Foulford Bottom and Cranesmoor to the south of the A31.

4.5.1.7 Dark Water

The Dark Water rises around 30m OD close to Hardley Bridge (SU 420048). It is joined in King's Copse Inclosure by the Stock Water. The Dark Water joins the sea at Lepe where it is controlled by tidal flaps.

4.5.2 Channel & Floodplain geomorphology

Channel and floodplain form is a result of the processes of erosion, deposition and sediment transport over time. The processes are naturally constrained by the geology and topography of the catchment and the way in which the river responds to changes in climate and hydrology.

The natural form of many New Forest streams is a sinuous meandering channel of variable width and depth that is laterally, relatively stable and contains pools, riffles and debris dams (except in flood). However, a number of streams throughout the Forest catchments have been modified by straightening, deepening and removal of debris dams.

The gradient of most of the streams is relatively low ranging from 1% - 0.6%. The majority of channels are less than 5m wide with shallow flows. Channels wider than 7m and more than 1m deep are limited to the lowest reaches of the Lymington & Beaulieu rivers. The streams with the steepest gradients are generally the Hampshire Avon tributaries which drain down from the highest areas of the Forest. Debris dams can have a significant influence on channel width resulting in a greater variation in widths than might be found on a non-forested stream.

Distinct areas of floodplain border the natural channels of the Forest streams and display a typical range of floodplain features such as:

- ephemeral channels - (sinuous , linear scour features around 50cm wide and 5-50cm deep)

- pools and hollows
- wake deposits - material deposited behind obstacles such as trees, tussocks and woody debris
- abandoned channels – old river channels left one part of the floodplain when the river moved laterally elsewhere
- woody debris, trees & vegetation
- shallow man made drainage channel lawns

Even where the channels have been over deepened and flooding is less frequent remnant features can often be discerned.

Table 4-14: Principal Watercourses & Tributaries

Principal Watercourse	Length (km)	Named Tributaries	Gauging/Monitoring Stations
Avon Water	18.5		✓(Flexford)
Lymington River	15.0	Bagshot Gutter Warwickslade Cutting Longbrook Highland Water Bratley Water Blackensford Brook Blackwater Fletchers Water Silver Stream Mill Lawn Brook Ober Water Etherise Gutter Passford Water	 ✓ (Highland Water 1 & 2, Brockenhurst ✓(Blackensford Brook, Blackwater 1) ✓(Blackwater 2) ✓(Blackwater 3) ✓ (Ober Water 1)
Beaulieu River	26.0	Worts Gutter Shepton Water Penerley Water	Hartford Bridge (ultrasonic) Beaulieu Gates Penerley Farm
Bartley Water	12	Millstream Fleet Water	Ashurst Bridge Totton (Tidal)
Cadham River	-		
Hampshire Avon		Millersford Bottom Black Gutter Ditchend Brook Latchmoor Brook Huckles Brook Dockens Water Linford Brook	 ✓ (Dockens Water)
Dark Water		Stock Water	

4.5.3 Flow

The New Forest streams are fed by a combination of mires, bogs and surface water run off and through flow. Many of the streams typically have a mean daily flow rate of less than 0.5 m^3s^{-1} during dry weather (Langford, 1996) and flows can be considerable lower during periods of summer drought. Flows measured at the gauging stations on the Dockens Water and the

Lymington River are shown in Table 4-15 which give values for two contrasting streams. Further flow data for the Hampshire Avon Tributaries is given in Appendix J. The rivers and streams are characterised by their flashy nature and can rise rapidly in response to heavy or prolonged rainfall as shown in the hydrographs for the Lymington River and Dockens Water (Figure 4.11 & 4.12). Flood peaks tend to pass through quickly and during out of bank events the total magnitude of the flow cannot always be recorded.

During the summer months those streams fed by well developed seepage steps or mires continue to flow although at a much reduced level with only a few centimetres depth of water. However a number of streams, particularly the Hampshire Avon Tributaries are seasonally dry or reduced to a series of small pools separated by dry gravel bars or small trickles under the surface gravel. Often only the deeper pools scoured out behind debris dams or on the inside of meanders contain any water.

Figure 4.11 - Sample Hydrograph of Gauged Daily Flows of Lymington River at Brockenhurst

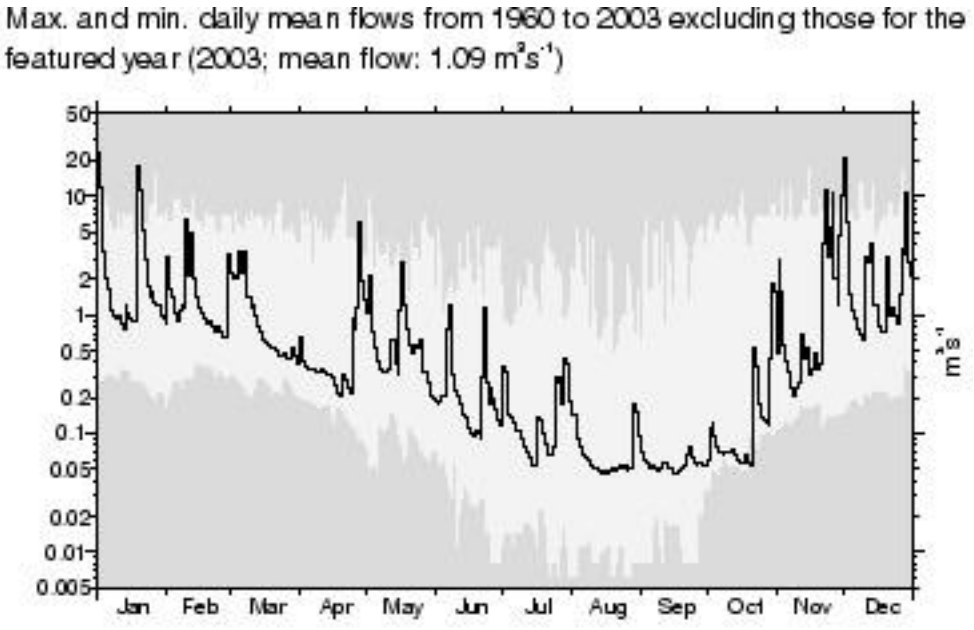
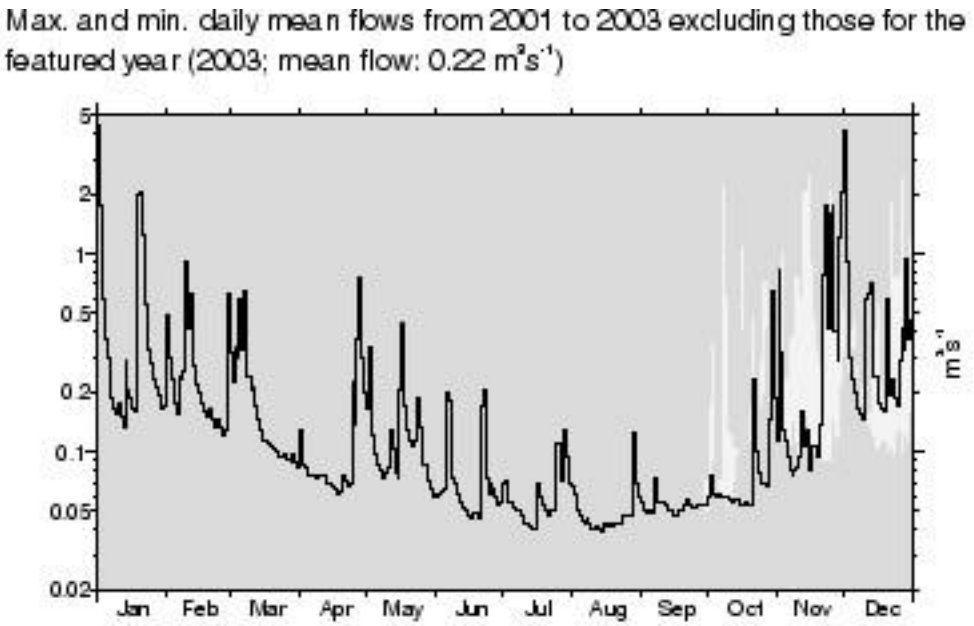


Figure 4.12 - Sample Hydrograph of Gauged Daily Flows – Dockens Water at Moyles Court



Source: Centre of Ecology & Hydrology

Table 4-15: Flow Statistics

	Lymington (R. Lymington at Brockenhurst)	Hampshire Avon Tributaries (Dockens Water)
Catchment Size	98.9 km^2	17.15 km2
Permeability	Mixed permeability	Low to Mixed permeability
Mean Annual rainfall (1961-90)	854 mm	831 mm
Elevation	8.4-117.7m	-
Mean flow	1.06 m^3s^{-1}	0.26 m^3s^{-1}
95% exceedance (Q95)	0.052 m^3s^{-1}	0.047 m^3s^{-1}
10% exceedance (Q10)	2.816 m^3s^{-1}	0.592 m^3s^{-1}

Source: Centre of Ecology & Hydrology

4.5.4 Flow patterns

Flow patterns are characterised by glides (slow flowing water), riffles (medium flowing water) and runs (fast flowing water). Life 3 studies in the Blackwater and Highland Water sub-catchments found that glides tend to be the most common form of flow followed by riffles and runs. Pools (still water) are noticeably rare in modified reaches being replaced by glides or runs. Pools where they occur are usually found at meander bends apices. Cascades and small water falls also occur at the faces of debris dams. Channelisation tends to affect the flow type in that it reduces the number of pools. Dominant flow types for the Highland Water and Black Water are shown in Figure 4.13. It is probable that a similar pattern would be found in the other river catchments.

4.5.5 Bank & bed material

Bank material is made up of clay, fines, sand and gravel. The banks tend to be dominated by cohesive, fine-grained material incorporating gravel as individual clasts or as a layer of basal gravels. Where the bed of the river has been lowered either artificially or as a result of incision, the underlying valley gravels have sometimes been exposed, but the overlying layer of fines is nearly always present and often covers more than half the bank face. Where no bed level changes have occurred, the banks are usually composed of more than 75% fines. The main composition of bed material making up the banks of the Highland Water and Black Water is shown in Figure 4.14.

Coarse gravel forms the majority of bed substrate (around 75%) intermingled with fine gravel (24%) in a lesser amount. Despite sands and clays being a dominant feature of the local geology, fines (<1%) are virtually negligible indicating that few low energy areas occur within the main channel. It is also possible that the fine sediment load is transported to the lower reaches of the rivers where conditions are more favourable for deposition or washed out onto the floodplain during flood events.

4.5.6 Sediment transport

Southampton University's monitoring work on sediment transport in the Highland Water Catchment suggests that:

- Bed load transport is dominated by fine gravels and coarse sand
- Critical discharge for the onset of bed load motion is in the order of 0.25 m^3s^{-1} or 35% of bankfull discharge.
- The majority of bed load is derived from upstream bars and pools
- Riffles typically have stable gravel surfaces over which finer bed load is transported.
- Bed load transport rates are poorly correlated with discharge owing to supply exhaustion and the unsteady nature of the transport process

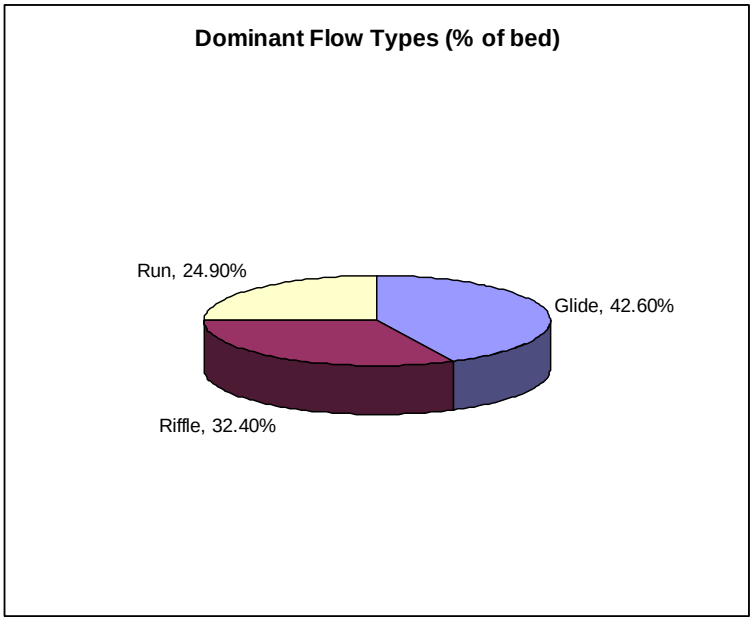
Bed load yields in semi natural reaches are low in comparison with other UK rivers due to the relatively low gradient, stable banks and relatively low stream power available for transport. However, comparison between a channelised and semi-natural reach of the Highland Water showed a 5 to 7 fold increase in bedload yield in the channelised reach for a range of flood events. This is thought to be due to:

- Greater confinement of higher flows within the channelised section (3.5 cumecs compared to 2.2 cumecs in the semi-natural reach)
- Increased slope due to lack of meanders
- Greater stream power for sediment transport due to higher width:depth ratios

Suspended sediment transport is characterised by the rapid rise and exhaustion of fine silts and clays with concentrations reaching around 1700 mgl^{-1} during high magnitude events. Flood yields may reach 176 tonnes though the typical flood yield is around 5-20 tonnes.

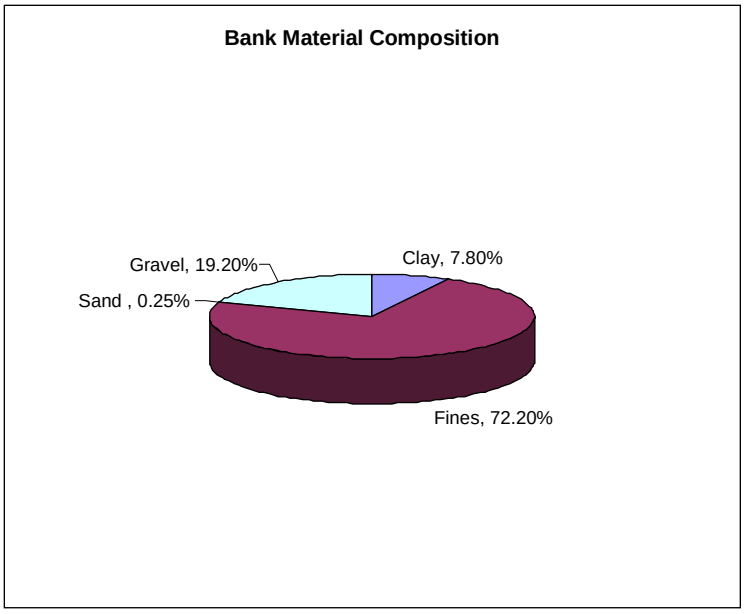
Over bank sedimentation is highly variable and depends on a number of factors including the presence of debris dams and exit pathways onto the floodplain. Once on the floodplain, deposition rates are strongly influenced by vegetation patterns and microtopography of the floodplain surface. Floodplain deposits are dominated by fine silts with high organic matter content.

Figure 4.13: Dominant Flow Types along Black Water and Highland Water



Source: Geodata Institute

Figure 4.14: Bank Material Composition



Source: Geodata Institute

4.5.7 Debris Dams

Debris dams are important features along the Forest streams, particularly in wooded catchments where large woody debris occurs on the floodplain. Debris dams are generally made up of naturally fallen woody debris and/or cut logs from forestry operations. Debris dams have a number of different forms as highlighted in Table 4-16. Debris dams are of significance because they:

- Influence the morphology of the channel including the pool-riffle sequence, roughness of the channel, bank stability and locations of sediment deposition. This variation in stream morphology is important in maintaining the diversity of aquatic life characteristic of New Forest streams.

- Act as sediment and gravel traps

- Promote over bank flow in localised areas to the benefit of floodplain habitats

- Hold back and thus slow up the rate of downstream flow particularly during peak discharges. The rate of water attenuation can be significant in the Forest streams given their flashy nature. For example, it was found that over a distance of 4028m the presence of 93 dams delayed the progress of small flood peaks by 100 minutes and large flood peaks by 10 minutes (Gregory et al, 1985)

- Provides food for invertebrates and shelter for fish

Table 4-16: Debris Dam Classification

Classification	Form	Hydraulic Influence
High Water Dam	Tree fallen across channel	Minor hydraulic influence during over bank flow
Partial Dam	Small accumulation of debris that partly spans the channel	Slightly disrupts flow hydraulics and usually reduced cross-sectional area
Complete Dam	Debris accumulation spans the channel	Affects hydraulics but does not pond water
Active Dam	Accumulation that spans the channel	Ponds Water
Other	Compiled from non-woody debris e.g. clay plug	Variable

Source: Geodata 2003

The frequency of debris dams along a river reach is variable over time. For example, periods of storminess can increase the amount of woody debris available to form dams, flood events can dislodge and flush them out or they can be deliberately removed. Gregory et al (1993), in their study of the Lymington River Basin found that 45% of gross woody debris load resulted

from storm blow down and the remaining 55% varied according to distance downstream and land use factors. The greatest loads were found in deciduous woodland areas
Table 4-17 shows the relative spacing of debris dams in the wooded catchments of the Highland Water and Black Water during 2002.

Table 4-17: Debris Dam Spacing along Highland Water and Black Water (2002)

	Debris Dam Type				
	All dams	High Water	Partial	Complete	Active
Reaches with dams	65	14	52	39	36
Mean spacing (m)	76	279	170	225	241
Min spacing m)	14	10	26	43	51
Max spacing (m)	310	1128	744	585	744
Reaches without dams	7	N/A	N/A	N/A	N/A

Source: Geodata 2003

4.5.8 Erosion

Bank erosion is due to a number of different factors. The most common types of erosion are fluvial erosion, particularly at apices of meander bends, and poaching by livestock. Direct bed and bank erosion by debris dams is usually confined to a small zone around each dam. However, sediment eroded from this zone tends to be dumped immediately downstream, narrowing the channel and deflecting water at the banks, resulting in more fluvial erosion and deposition, thus altering channel morphology.

However of greater significance to wetland restoration works is the damage caused by secondary erosion instigated by historic channel modifications.

4.5.9 Water Quality

The Forest streams are typically base poor with low nutrient concentrations. Water chemistry varies according to the underlying geology, soils and land use. Waters are particularly acidic in the upper reaches of the catchments which can give rise to the reddy coloured water due to rapid oxidation of iron deposits in the water. Historically water from the Forest springs have been used for medicinal purposes such as the treatment of leprosy, opthalmic disorders and mange in dogs (Langford, 1996)

Suspended sediment concentrations during dry weather flows are typically between 5-25mg per litre rising to greater than 200mg per litre during spates (Langford 1996). Pollen and spores from plants form a significant proportion of this load.

Water quality data for the New Forest streams is given in Appendix K. Water quality throughout the New Forest is routinely monitored by the Environment Agency. The quality of

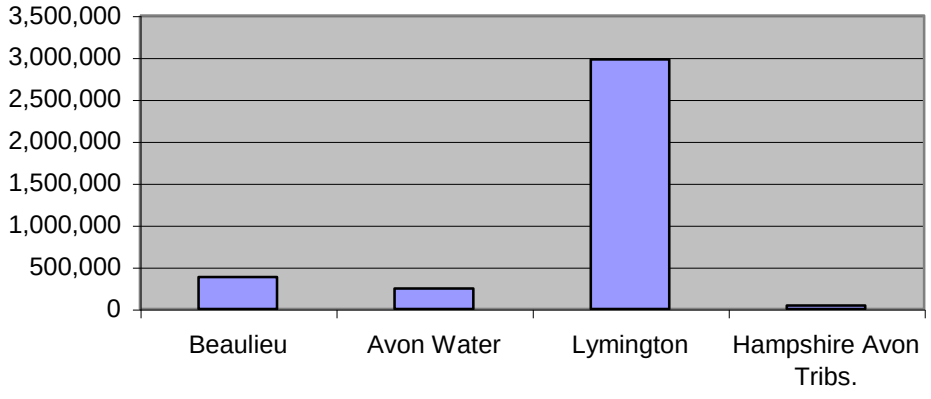
the rivers is assessed using the River Ecosystem Classification Scheme. Each stretch of river has been assigned a River Quality Objective which reflects the chemical quality requirement of aquatic plants and animals. General Quality Assessments are used to look at trends in water quality and use different aspect of water quality such as biology, chemistry, nutrients and aesthetics. A further explanation of these schemes is also given in Appendix K. The results presented in Appendix K give a useful snapshot in time of the water quality within the New Forest rivers and streams. The majority of river and streams are of good quality. Marginal and Significant failures are at times due to problems at sewage treatment works, or seepage from septic tanks or urban runoff.

4.5.10 Abstractions

Abstractions are licensed by the Environment Agency and take place from several sources along the New Forest streams (Appendix L). The largest licensed abstractions (Figure 4.15) are located at the lower end of the Lymington River for public water supply but have not been utilised for several years. However it is intended to bring the abstraction back on line in the near future. Other key abstractions tend to be for spray irrigation.

In addition to the amount abstracted under licence, a significant volume is also abstracted for trickle irrigation for soft fruits, particularly along the Beaulieu River. To date no licences have been required for this type of abstraction because it has not been required under law. The Water Act now makes it licensable and this will come into force in 2007 at the earliest.

Figure 4.15: Maximum Licenced Abstractions (m^3)



4.5.11 Flooding

The winter of 2000/01 was one of the wettest winters ever experienced in Hampshire and most areas prone to flooding did so at some point during this time. In addition to the natural flooding of the floodplain, a number of properties were also inundated. Flood reports compiled by the Environment Agency for this period are useful in identifying where flooding of properties in the catchment occurs and by what means (Table 4-18). However it should be noted that actions have since been undertaken to reduce many of these sources of flooding. Analysis of rainfall records and river flows confirmed that the majority of flooding occurs in response to short duration intense rainfall events, rather than to an accumulation of rainfall over a period (Halcrow/Environment Agency 2002). Anecdotal evidence from Forestry Commission staff suggest that the rivers and streams can over top their banks after only a few hours heavy rainfall, particularly when the ground is already saturated.

Flooding of properties is not always due to overtopping of river banks but from a variety of other means, notably:

- Raised ground water levels
- Under capacity of the drain and sewer network to cope with large volumes of surface run off.
- Backing up of drains and ditches
- Storm surge affecting the river estuary combined with high levels of fluvial flow in the rivers and/or spring tides.

Historically, Brockenhurst has experience flooding from the Weir Stream (a tributary of the Lymington River) with over 100 properties flooded in 1966. In the mid 1990's a flood alleviation scheme was implemented in the village which is understood to afford protection up to 1 in 25 year events. This is thought to have prevented flooding to the centre of Brockenhurst in 2000/01.

However, natural flooding of the floodplain to maintain the condition of New Forest SSSI in the upper catchments is important as highlighted in Chapter 2.

Table 4-18: Flooding of Property

River Basin	Location	Causes of flooding
Avon Water	Sway	Surface water runoff Overwhelming of drainage network
	Keyhaven	Fluvial flooding exacerbated by surge tides
Lymington River	Lymington	Raised local aquifer High surface water flow overwhelming sewage & wastewater drainage Surface water runoff Backing up of streams Overtopping as a result of combined high river flow and storm surge
	Brockenhurst	Surface water runoff Inadequate performance of storm water drains Overtopping from the Weir Stream
	Portmore	High surface water runoff overwhelming drainage network
Beaulieu River	Ipley Manor	Fluvial flooding combined with surge tide effects
	Beaulieu	Fluvial flooding combined with surge tide effects
	Lyndhurst	Stream overtopping (various events recorded between 1875-1938)
Bartley Water	Bartley	Overtopping from Bartley Water Backing up of sewage network Surface water runoff
	Minstead	High groundwater levels & sewer surcharging
	Woodlands & Netley Marsh	Inadequacy of Lanes Bridge to pass high flows High surface water runoff overwhelming sewage system, drainage network + blocked ditches
	Ashurst	High groundwater levels result in ingress and surcharge of sewers.
Cadnam River	Cadnam	Surface water runoff Overtopping from Cadnam River Overwhelming of drainage system
	Copythorne	Surface water runoff
	Ower	Overwhelming of drainage system
	Winsor	Flooding from sewage system Backing up of drainage ditches
Hampshire Avon Tributaries	N/A	N/A

Source: Halcrow/Environment Agency – Winter 2000-2001 Flooding in Hampshire Reports

4.6 AIR QUALITY

Air Quality monitoring is carried out at a number of sites across the New Forest by New Forest District Council in accordance with their statutory duty under the Environment Act 1995. Results are assessed against the Government's UK air quality objectives (Table 4-19). On the whole air quality across the New Forest SSSI meets the UK air quality objectives except in localised areas in the centre of Lyndhurst which can be attributed to traffic congestion.

Table 4-19: UK air quality objectives

Pollutant	Objective	Compliance date
Benzene	16.25 µg/m^3 running annual mean 5 µg/m^3 annual mean	31 Dec, 2003 31 Dec, 2010
1,3-Butadiene	2.25 µg/m^3 running annual mean	31 Dec, 2003
Carbon monoxide	10mg/m^3 max daily running 8 hr mean	31 Dec, 2003
Lead	0.5 µg/m^3 annual mean 0.25 µg/m^3 annual mean	31 Dec, 2004 31 Dec, 2008
Nitrogen dioxide	200 µg/m^3 1 hour mean, 18 exceedences 40 µg/m^3 annual mean	31 Dec, 2005 31 Dec, 2005
Particles (PM10)	50 µg/m^3 24 hour mean, 35 exceedences 40 µg/m^3 annual mean	31 Dec, 2004 31 Dec, 2004
Sulphur dioxide	350 µg/m^3 annual mean 1 hour mean, 24 exceedences 125 µg/m^3 24 hour mean, 3 exceedences 266 µg/m^3 15 minute mean, 35 exceedences	31 Dec, 2004 31 Dec, 2004 31 Dec, 2005

4.7 CLIMATE

4.7.1 Climate Statistics

Located in the climatic region of central southern England, the New Forest generally experiences warm summers and mild winters. Rainfall is higher than average for south east England. Small falls of snow are experienced most winters but large, extended falls are rare. Frosts are common, but night temperatures seldom fall below -9^{O}C. The area is not subject to frequent strong winds and values of windiness are classed as very suitable for all timber producing species.

Climatic statistics for weather station at Everton the south of the Forest are shown in Table 4-20.

Table 4-20: Climate Statistics from Everton Weather Station (16m AMSL) (1971-2000 averages)

Month	Max Temp ^{O}C	Min Temp ^{O}C	Days of Air Frost	Sunshine Hours	Rainfall mm	Days of Rainfall >=1mm
Jan	7.9	2.6	8.3	61.7	81.0	12.8
Feb	7.9	2.3	7.2	81.1	58.7	10.3
Mar	10.1	3.6	4.4	121.8	60.3	10.6
Apr	12.4	4.7	2.0	181.5	48.4	8.8
May	15.9	7.7	0.1	223.2	45.9	8.4
Jun	18.4	10.4	0.0	212.4	51.9	7.8
Jul	20.8	12.5	0.0	231.6	37.7	6.5
Aug	20.8	12.6	0.0	223.2	49.5	7.1
Sep	18.3	10.7	0.0	160.2	67.1	9.5
Oct	14.9	8.2	0.3	120.0	88.0	10.9
Nov	11.1	5.0	3.8	80.7	84.2	11.0
Dec	9.0	3.6	6.3	53.3	91.2	12.1
Year	14.0	7.0	32.5	1750.7	763.7	115.8

Source: Meteorological Office

Small micro climatic variations do occur across the Forest as a whole, generally in response to topographic changes. For example, the highest levels of rainfall (around 900mm) tend to occur over the highest ground in the north and west. Rainfall is the principle source of water feeding the Forest streams via percolation and overland flow. As a result variations in river flows tend to closely reflect the intensity and duration of rainfall thus the Forest streams are characterised by their flashy nature. However, during prolonged, dry summers many of the ponds, ephemeral wetlands and smaller streams dry out whilst others are reduced to a mere trickle.

4.8 MATERIAL ASSETS – CULTURAL HERITAGE & ARCHAEOLOGY

4.8.1 Archaeological Sites

The New Forest contains a unique and special archaeological resource which has been largely well preserved due to the land use history, the protection afforded by Forest Law and by modern day conservation designations and management. However, some sites have been damaged by previous drainage works and forestry operations. The Forestry Commission has drawn up an "Archaeological Management Plan for the Crown Lands of the New Forest" which outlines the general approach to the management of archaeological sites.

There are some 2,000 sites of archaeological and historic interest recorded in the New Forest area. Over 260 of these sites are designated as Scheduled Ancient Monuments (SAMs). Such sites are afforded protection under the Ancient Monuments and Archaeological Areas Act

1979 and the National Heritage Act 1983. At least 155 SAMs are designated within Crown Lands. The location of these sites relative to the river basins is shown in Figure 4.16.

In addition, there are numerous other known archaeological features. Advice on the location and nature of these sites is provided by the Hampshire County Council Archaeologist and Hampshire Field Club.

Table 4-21 summarises the archaeological history and evidence found in the Forest today.

Table 4-21: Archaeological History

Archaeological History	Evidence
Bronze Age (2500 – 750 BC)	Evidence of woodland clearances for stock grazing. Numerous burial mounds mainly located on the heaths
Iron Age (750BC – 43 AD)	Hillforts and enclosures
Roman Invasion (43AD – 400AD)	Evidence of Roman Pottery industry particularly in north of the Forest around Islands Thorns, Amberwood and Sloden Inclosures. Small sections of Roman Road have also been found suggesting that the Forest may have been of strategic value to the occupying army.
Anglo-Saxon Period (400AD-1066AD)	Evidence of small scale settlement and abundance of features including park pales, Royal hunting lodges and boundary banks.
Post Anglo-Saxon	Inclosure Earthworks, coastal salterns, bee gardens and Second World War infrastructure

Wetland/SSSI restoration works have to date encountered the following types of site:

- Boiling Mounds
- Charcoal pits
- Pounds
- Kilns

4.8.1.1 Boiling Mounds

Boiling Mounds, sometimes referred to as Burnt Mounds are usually located close to watercourses. They are characterised by spreads of burnt material and fire cracked flints. Excavation sometimes reveals evidence of structures below or within the spread of burnt material. It is thought that such sites were used to heat water using heated stones. They may have been sites where feasting, food preparation, ritual washing or sweating took place.

Boiling Mounds are not well understood and it is considered important that sites are protected for their archaeological potential. More boiling mounds have been recognised in the New Forest than anywhere else in Hampshire. It is likely that their origins and purpose are closely

associated with the Forest and understanding them in the future may give an insight into how prehistoric society used and valued the Forest.

4.8.1.2 Charcoal Production

It is thought that charcoal was used in the New Forest iron and gun powder industries. Charcoal sites would have comprised a wood stack, mounded with earth and leaves to allow a slow burning fire. The archaeological evidence of such sites is slight and is associated with patches of black ground. The mound, or kiln, may leave a large circular bank, between 6 – 13 meters in diameter. The charcoal burner would have had a hut adjacent to the mound. The working area of the mound and charcoal burners hut may result in a terrace which can be particularly apparent on steeper slopes. The sites are sometimes associated with sawpits.

4.8.2.2 Pounds

Pounds are associated with stock management in the Forest and were used for pigs, goats, horses, cattle and sheep. The evidence of pounds can be seen in small oval, rectangular and D-shaped earthworks and are slighter but more sharply defined than the earthworks associated with lodges. Many are found on the high ground to the west of the forest. It is possible that they were used seasonally and associated with droving or transhumance activity.

Pounds form a visible reminder of the woodland heritage and are an integral part of historic woodland use and character of the Forest.

The earthworks are fragile and vulnerable to damage and erosion.

4.8.2.3 Roman Kilns

Roman Kilns are considered to be of very high archaeological importance. Kilns are the structures in which pottery was fired. They may be discernible on the surface as a low mound or entirely buried. They are sometimes associated with other related archaeological features such as other kilns, waste heaps, terraced working areas, clay extraction pits or dams on watercourses. Waster heaps are accumulations of pottery shards discarded during the production process which may show up as low mounds or concentrations of pottery.

Roman kilns are of archaeological importance for the insight that they provide into Roman pottery production, industrialisation and economy as well as providing a chronological framework against which to date pottery from other archaeological sites. The sites are fragile and vulnerable to damage.

4.9 LANDSCAPE

4.9.1 Existing Landscape

The landscape of the New Forest is…

> *"…. an exceptional landscape which has largely escaped the changes brought about elsewhere by modern agriculture and industrial society. Its character still reflects the medieval Royal Forest which covered much of the area. It is a landscape of great beauty, which conveys peace and tranquillity and gives inspiration and great enjoyment to many people. Above all the Forest is a living landscape; its character still shaped by traditional land management and the way of life of local people."* New Forest Committee 2003

The Forest has been subdivided into twenty-seven Landscape Character Areas to assist with planning and development control within the Forest. Table 4-22 shows which Landscape Character Areas the river basins fall into. Descriptions of the key characteristics of these Landscape Character Areas in relation to the river basins are given in Appendix L.

In recognition of the special qualities of the landscape, the New Forest Heritage Area has been subject to tight planning control and the designation of the New Forest as a National Park will continue to give this statutory protection. Indeed the key purposes of the New Forest National Park are to:

- Conserve and enhance the natural beauty, wildlife and cultural heritage of the Park, and
- Promote understanding and enjoyment of its special qualities

The New Forest has also been recognised for its unique cultural landscape and exceptional natural beauty by its inclusion on the Government's Tentative List of World Heritage Sites and has been accepted by UNESCO as meeting the requirements for inclusion on the Tentative List. A decision is still awaited from the UNESCO World Heritage Committee.

Table 4-22: Landscape Character Areas

Landscape Character Area	Avon Water	Lymington River	Beaulieu	Bartley Water	Cadnam	Hampshire Avon Tributaries
Upper Avon Valley						✓
Poulner Woods & Pastures						✓
West Wellow Heaths & Common					✓	
Copythorne Forest Farmlands				✓		
Hythe & Ashurst Forest Farmlands			✓			
North West Solent Estates			✓			
Lymington & Pennington Coastal Plain	✓	✓				
Sway Pasture & Smallholdings	✓					
Southern Heath & Forest	✓	✓				
Northern Heath & Forest		✓				✓
Furzey Woodland & Villages				✓	✓	
New Forest Central Woodlands		✓				
Lymington River		✓				
Beaulieu Heath			✓			
Beaulieu River			✓			
Eastern Forest Heaths			✓			

5 IMPACTS & MITIGATION

5.1 INTRODUCTION & METHODS OF IMPACT ASSESSMENT

This chapter sets out the key generic impacts associated with the Pathfinder works. It also highlights any specific issues associated with the individual work sites identified to date. It should be noted that a detailed work plan will be prepared for each site as the project progresses which will be subject to discussion and agreement by key consultees, notably English Nature, Verderers, CDA and Forestry Commission keepers. It is intended that this will flag up any specific issues not yet identified as part of this preliminary EIA. In addition an Operational Sites Assessment (OSA) is also carried prior to any works in an Inclosure which is also designed to flag up any site sensitivities.

The degree of individual impacts are summarised at the end of the chapter in Table 5-8. Where relevant, impacts have been assessed both during and after the works. The assessment of degree of impact is subjective based upon the following categorisation:

Negligible – No degree of impact discernable
Minor – Impacts are only likely to have a very small overall effect
Moderate – Impacts are likely to be noticeable
High – Impacts are likely to be significant and long lasting

Temporary – impact will only be very short term, normally only lasting during the period of the works but could persist for up to 1 year post construction
Short term – impact only likely to be noticeable up to 1 -3 years post construction
Medium term – impact likely to persist for 3 to 5 years
Long term – impact will be discernable for more than 5 years

Positive – impacts will have a beneficial effect on the environment
Negative – impacts will have a detrimental effect on the environment
Neutral – impact have neither a positive or detrimental effect on the environment

The degree of impact assessment assumes that the appropriate mitigation/good practise guidelines have been implemented or adhered to.

Impacts are identified in accordance with the environmental interests highlighted in Chapter 4, notably:

- Human beings
- Flora & Fauna
- Soil
- Water
- Air
- Climatic Factors
- Material Assets
- Landscape

5.2 IMPACTS ON HUMAN BEINGS

During the works

The main effects on Human beings relate to health and safety issues during the works as identified below.

i. Toxicity of sprays

Due to the extent of exotics invasion and the large area that needs to be targeted, mechanical methods of eradication combined with chemical methods of eradication have had to be adopted. The Pesticides Safety Directorate assesses potential risks to the public from pesticide applications before product approval is granted. Thus provided sprays are carefully selected and used in accordance with manufacturer's guidelines the toxicity risk should be within acceptable limits and presents minimal risk to human health and the environment (refer to Table 5-1). Particular care will be required when using Trichlopyr that it is not used near a watercourse or drain as this particular spray is not safe for use near water.

However in accordance with good practice the Forestry Commission:

- Carries out a health & safety assessment of individual sites prior to spraying giving consideration to the level of public use and other forest users.

- In busier areas close to well used tracks or car parks buffer zones are established by temporarily excluding forest users with the use of warning signs and tapes. If necessary car park closures will take place but this is avoided is at all possible.

Forest Research has recently reported that one of the main reasons for tree loss in forest plantation is due to herbicide application on surrounding vegetation. To date this has not been a significant problem in the New Forest and can be avoided through continued good practice in the application of herbicides.

Table 5-1: Pesticide characteristics

Pesticide	Mode of Action	Rate Applied of Active Ingredient	Toxicity to mammals (rats) (LD_{50},mg kg^{-1}	Toxicity to mammals (rats): oral NOEL (mg kg^{-1} by diet or b.w. (duration)	Hazard classification of product formulations	Toxicity to invertebrates (bees) (LD_{50} μg per bee	Hazard classification potential risk to aquatic life	Selectivity	Activity	Potential volatiser
Glyphosate	Herbicide	0.54 – 3.6kg ha^{-1} 54-360 mg m^{-2}	Oral - >5010 Contact>5000	410 diet (2 years)	**Risk of serious damage to eyes**: Barclay Barbarian, Barclay Gallup 360, Buggy SG **Not hazardous:** Roundup Pro Bioactive, Envision, tumbleweed Pro Pro, Barclay Gallup Biograde, Barclay Gallup Biograde Amenity, Barclay Gallup Hi-Aktiv, Glyfos Gold, Glyfos Pro Active, Greenaway Gly-490, Hilite, Habitat, Kernel, Manifest, MSS Glyfield, Roundup Greenscape Skin sensitiser: Glyper **Irritating to eyes and skin:** All other formulations	Not toxic >100	Harmful (except for Roundup Pro Biactive, envision	Low	Medium	No
Asulam	Herbicide	2-4 kg ha^{-1} 200-400 mg m^{-2}	Oral >4000 Contact >1200	400 diet (90 days)	Not hazardous	Not toxic <2% w/v	Not harmful	High	Medium	No
Trichlopyr	Herbicide	0.96-3.84 kg ha^{-1} 96-384 mg m^{-2}	Oral 577 Contact >2000	3 b.w. (2 years)	Harmful if swallowed or in contact with skin. Irritating to eyes & skin Skin sensitiser	Not toxic >100	Dangerous	Medium	Medium	Yes

Source: Forestry Commission - Reducing Pesticide Use in Forestry

ii. Noise Disturbance

During construction

The majority of works involve machinery working on site, ranging from chainsaws through to heavy plant. Typical examples of machines that might be working during various works and their noise levels are shown in Table 5-2. To put noise levels in context:

- Quiet Inclosure with background leaf rustle and bird song = 37db(A)
- A person talking in a normal voice = 60 db (A)
- Busy main road = 75 db(A) (10m from A31)
- Ambulance siren = 120 db(A)

Noise attenuates rapidly with distance[1] and most of the Pathfinder sites are remote from properties so noise disturbance is not an issue in this respect. However some forest users (walkers, cyclists or horse riders may be aware of noise emanating from work sites when passing close to the site. The degree of awareness will depend to a certain extent upon the climatic conditions prevailing at the time. Works around Ober water may be heard at Aldridgehill Camp site, depending on wind direction and if works are taking place during the summer when the campsite is open.

Table 5-2: Noise levels from work site machinery

Activity	Potential Machinery & Plant used on Site	Noise Level
Conifer removal	Harvester Forwarder Chainsaw Skyline	<92 db(A) <92db(A) 106-111db(A) <92 db(A)
Exotics removal	Chainsaw Excavator Tractor mounted sprayer Small ride on tractors	106-111db(A) <92 db(A) <92 db(A) 83-91 db(A)
Drain infill/River restoration	Excavator Tracked dumper	<92 db(A) <92 db(A)

Contractors will be expected to adhere to the British Standard Code of Practice 'BS5228 Noise Control on Construction and Open Sites', as a minimum, and to use modern machinery with appropriate noise control mechanisms. Machines should be turned off when not in use.

In terms of workers exposed to construction noise, the Forestry Commission adheres to the Control of Noise at Work Regulations 2005.

Post Construction

None

[1] Attenuation in New Forest from road noise is 4-5 db/dd (double distance)

iii. Restricted access to timber harvesting sites

During Construction

Where works are taking place on Category A tracks to construct new ford crossings [NB Pitts wood] it will not be possible for heavy forestry vehicles to access timber stacks via that route.

Post Construction

Restoration works will result in the modification of some access routes within the Inclosures by taking out culverts and replacing them with fords. Timber harvesting of hardwoods takes place during the autumn/winter and there is the possibility that during wet periods when the rivers are high, it will not be possible for machinery and vehicles to use the fords, leaving certain forest stands temporarily isolated. This has already happened at the "concrete ford" in Vinney Ridge (November 05) when timber lorries were unable to cross the ford to pick up timber stacks. Although fords are only likely to be inaccessible for a matter of hours or possibly days during extreme rainfall events, plans for timber extraction routes and locations for timber stacks may need to be given additional thought during the planning stages of timber harvesting. Gauges will also need to be installed at certain fords to assist timber lorries assess the feasibility of crossing fords in flood.

Additional pollution prevention measures will also have to be taken at ford crossings during timber extraction to limit excess sedimentation, including the use of Heather bales and/or booms or sediment mats.

iv. Restrictions to recreational access

During the works

During the works where there is a health and safety risk to the public from plant movement, machinery or sprays, certain parts of Inclosures, including tracks and parts of the cycle network may have to be temporarily closed for the duration of the works. Speed limits will be imposed on plant using forest tracks. Warning notices will be posted both in advance and during the work informing the public about the works and giving contact details for further information. Forestry Commission Rangers are also on hand to inform the public about the nature of the work and discuss any issues which arise. Guided walks will also be carried out along certain sites particularly those that are popular with the public to provide first hand information regarding the works.

Those sites where there are potential sensitivities associated with recreational routes are identified in Table 5-3.

Post works

No restrictions

Table 5-3: Site sensitivities relating to recreational interests

Site	SSSI Unit No	Sensitivities
Coppice of Linwood	109	Cycleway
Kings Garn Inclosure	111	Cycleway
Slufters	113/114	Cycleway
Knightwood	362	Cycleway
Vinney Ridge	500	Cycleway, Waymarked walks
Poundhill Inclosure	504	Cycleway, Waymarked walks, Wagon route
Fletchers Thorns Inclosure	499	Cycleway, Wagon route
Clumbers	502	Cycleway
Wootton Brownhills	537	Cycleway
Milkham	116	Cycleway
Broomy/Amberslade	552	Cycleway
Aldridgehill	502	Close to Aldridgehill campsite
South Oakley	561	Cycleway
Knightwood	362	Waymarked walks
Camel Green, New Park, Hurst Hill	497	Wagon route

v. Changes or alterations to stream crossings

During construction

Refer to impact iii

Post construction

In order reduce the amount of canalisation some culverted sections of watercourses will be removed and replaced with open channels (NB Pitts Wood). Where these culverts currently provide stream crossings they will be replaced by suitably designed fords to allow safe crossing by riders and walkers (wearing wellingtons or walking boots). However during times of flood it may not be possible to cross. These locations are not popular routes for walkers and during such weather conditions the number of walkers and riders out on the forest braving the weather tends to reduce significantly. Flood peaks pass through quickly and therefore fords would only be impassable for short periods (hours or days depending on the size and duration of event)

On Bramshaw Golfcourse, where culverts are to be replaced by open channel suitable dry crossings will be provided.

The existing ford crossings or bridges which are important for drifting purposes will be maintained and their design potentially improved in consultation with the Verderer's and CDA.

In Island Thorns a new ford (pedestrian/horse rider width) will be constructed in the location of a former bridge.

vi. Improvements to Grazing

During construction

Where earthworks are required or machinery results in disturbance to the soil surface then very small areas of grazing may be lost temporarily. This will be insignificant in the context of available grazing available in the vicinity. Access routes will be chosen to ensure that a minimal amount of ground disturbance takes place and will use previous access routes where they exist. Where machines need to work alongside streams and drains, where possible, work will be from one side of the bank only.

Post construction

The commoning community is concerned that restoration works do not affect the quality of the grazing and that the productivity of any new grazing is recognised when opening up new areas. Therefore it is important to understand grazing patterns of stock and the relative productivity of different habitat types. A detailed study examining the food and feeding behaviour of cattle and ponies was conducted in the late 1970's, the findings of which are still highly relevant today (Putman et al 1983).

Both cattle and ponies are selective grazers and follow fairly regimented patterns. Cattle use their preferred habitat types throughout the year and have a heavy preference for lawns and improved grasslands with extensive use of heathland. They tend to graze wet heath in summer and drier areas of heath in the winter. Feeding use of other communities is not extensive although deciduous woodland is exploited at times during the winter and acid grassland is used sporadically for most of the year. Cattle tend to spend less time actively feeding than ponies (60% compared to 75-88% for ponies) and restrict much of their feeding activity to daylight hours.

Ponies on the other hand exhibit a more marked seasonal and diurnal use of vegetation types. Improved grasslands and acid grassland are important throughout the year with streamside lawns being particularly favoured. Indeed the majority of ponies feed in discrete groups with each group having a favoured lawn which forms the focus of their grazing. However, wet heath, bogs and regenerating heathlands are used seasonally with peak use in the summer (May – September), which is related to *Molinia* growth which is the most important forage species in bogs and heathland. Feeding in gorse-brakes and deciduous woodland is largely restricted to winter, although woodlands are used for night feeding throughout the year. Indeed ponies tend to move off the lawns and heath during the night to seek shelter among the trees where they continue to graze throughout the night.

Although both ponies and cattle feed on lawns each has its own preferred area on the lawn. Ponies rarely graze their own latrine areas leaving areas of longer sward which in turn are utilised by the cattle which prefer to graze a longer sward.

The feeding preferences of cattle and ponies for different plant species are shown in Figure 5.1 while the productivity of different habitat types is shown in Table 5-4.

Table 5-4: Productivity and grazing pressure on different habitat types

Habitat Type	Growing Season Production (tons/acre)	Percentage removed by grazing
Reseeded lawns	0.90	94%
Commoners' improved grassland	1.31	86%
Streamside lawns	1.96	66%
Acid grassland	0.63	91%
Bog	1.84	89%
Molinia Heath	0.90	48%
Molinia Bog	0.90	48%
Juncus sp	4.89	72%
Bramble leaves	1.27	24%

Source: Putnam et al

The streamside lawns and mires are key sources of grazing for commoners' stock and indeed grazing is essential in maintaining the characteristics and sward composition of the SSSI habitats. Several areas of riverine woodland within the Inclosures would benefit from increased grazing and those Pathfinder fence realignment works at King's Garn Inclosure, Shave Green East, South Oakley and Burley New West will allow this to happen. In some wet areas poaching by stock is important in developing habitat diversity and encouraging species which would not otherwise colonise these areas.

Ponies are capable of foraging deep into mires which helps to control scrub ingress and maintains an open habitat. However, ponies are also quite territorial and are often reluctant to graze new areas even when the productivity of grazing on their favoured areas is low.

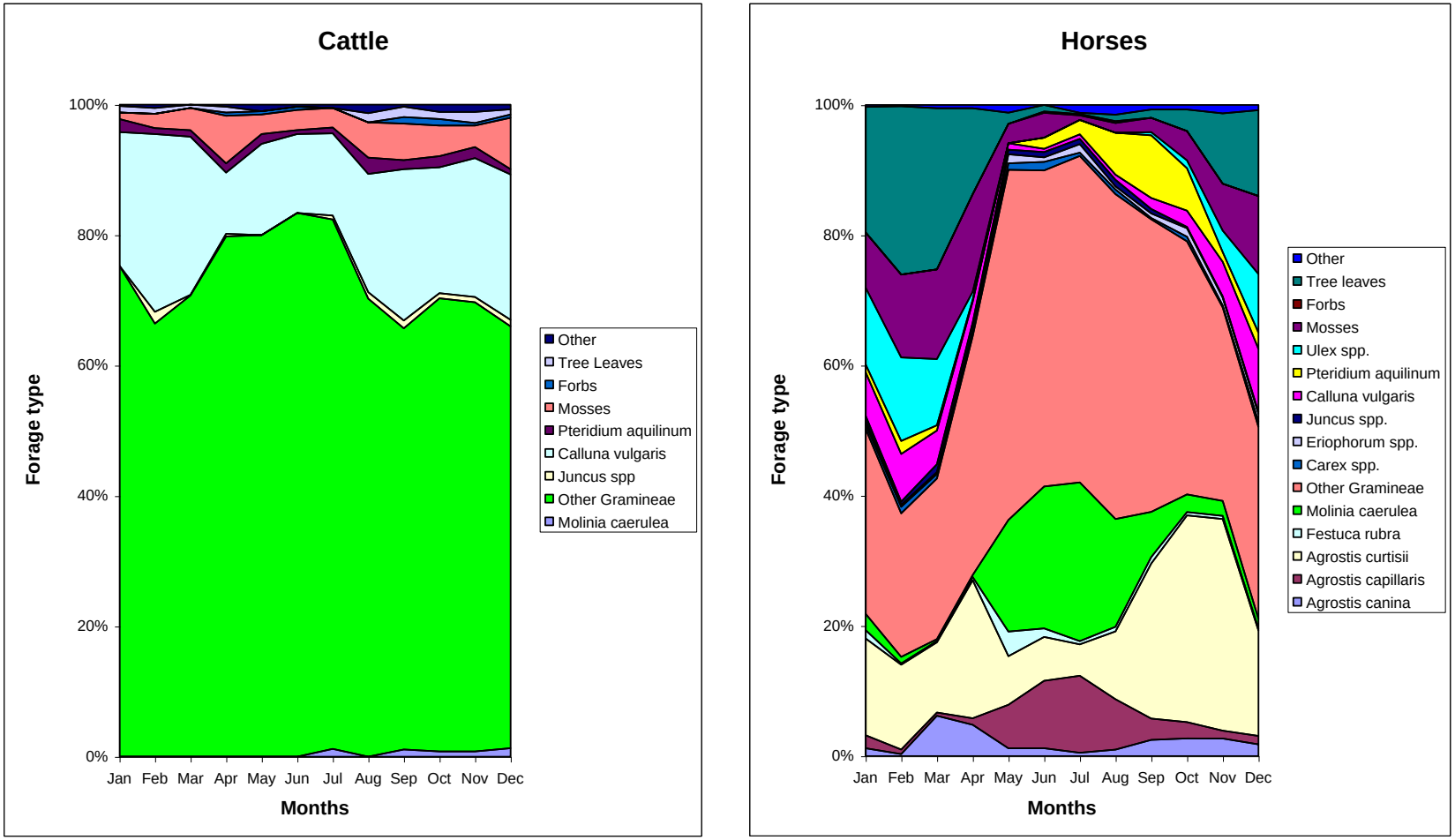
The wetland restoration works offer the potential to increase the area available for grazing through:

- Opening up areas within Inclosures for grazing
- Restoration of lawns
- Scrub clearance
- Erosion repair and drain infilling

It is important to ensure that the works are not detrimental to any lawns. Indeed it is anticipated that the works should improve grazing on alluvial grasslands by providing a flush of nutrients through short term flood events. Although alluvial grassland swards in the New Forest are fairly hardy to waterlogging around the roots it is important that the sward itself is not covered in water for long periods of time, preferably not longer that 2-3 days (Oakwood Environmental 1992, Scott Wilson/Environment Agency 1996). The flashy nature of New Forest streams ensures that they return to in bank rapidly after heavy rainfall events and flood peaks tend to pass through in a matter of hours rather than days.

It has also been noted that bracken prefers drier ground and it is possible that bracken coverage could reduce alongside restored watercourses. However, this will require observation and monitoring over time.

Figure 5.1: Forage Preferences of Cattle and Horses



Source: R.J. Putman et al (1987)
Based upon the percentage species composition of cuticular fragments in the faeces of New Forest cattle & ponies

vii. Maintenance of Drift Lines

During construction

Any works along known drift lines will be will be scheduled to take place to avoid coinciding with drift dates for that area.

Post construction

The pattern of fencing is important for maintaining drift lines during the annual round up of stock. When planning any changes to Inclosure faces the impact on drifting will be taken into account and any changes fed in to the FC database used for the "Foot and Mouth Contingency Plan".

As highlighted previously (refer to Impact v) crossing points will be maintained or replaced by suitably designed fords.

In order to maintain the drift line on Bramshaw golf course the Verderer's and CDA would prefer one culverted section to remain unaltered.

viii. Improved stock safety

During construction

If any Inclosure fences or swing gates across streams need to be removed temporarily during the works they will be replaced by a temporary fence at night to try and stop stock straying into Inclosures

The substrate in new ford crossings can take time to consolidate and provide a firm footing. Until materials firm up, soft substrates can spook stock crossing fords.

Post construction

Deep drainage ditches have resulted in stock fatalities in the past. The works will result in the infilling of many of the deeper, more dangerous ditches which may make the Inclosures safer for legitimate and/or straying stock.

ix. Socio- Economic Impacts

The restoration and maintenance works will provide some additional temporary employment for contractors and staff within the Partner Organisations.

The restoration work will result in the loss of some small areas previously used for commercial forestry. This has already been taken account of in the Forest Design Plans and an EIA prepared to support this. However these losses are unlikely to have any significant impact on forestry related employment.

At this point in time it is not envisaged that restoration works will result in any significant changes to the current grazing regime or recreational activities within the Forest.

x. Compliance with other policies & Plans

A review has been conducted of other Policies & Plans relevant to the area to ensure that there are no significant conflicts. Indeed the proposed works are in full accordance with policies, plans and objectives set out in:

- New Forest Special Area of Conservation Management Plan 2001
- Management Plan for the Crown Lands of the New Forest 2001-2006 and associated Subject Plans
- New Forest Wetland Management Plan 2006-2016

The Forestry Commission is also represented on the consultation forums set up by the Environment Agency for the New Forest Catchment Abstraction Management Strategy (CAMS) and New Forest Catchment Flood Management Plan. Therefore any strategic relevant issues relating to SSSI restoration are being fed into these Plans through the consultation process.

The National Park Management Plan is currently being drawn up but it is assumed that the Pathfinder works will not be contrary to the Plan's objectives.

5.3 IMPACTS ON FLORA & FAUNA

i. Disturbance to flora & fauna

During Construction

During the works some temporary disturbance to flora and fauna will be inevitable, particularly where people and machinery are working in remote areas of the Forest that suffer little from human disturbance.

There will be some temporary loss of vegetation due to soil disturbance and earth works by heavy machinery

Where possible felling works will take place outside the bird breeding/nesting season (March to July). However, prior to any felling inside Inclosures, an Operational Site Assessment (OSA) will be carried out to make sure that there are no sensitive nest sites and trees that are preferred nesting sites for buzzards or other raptors will be retained.

Badger setts are often found in the Inclosures, including those scheduled for Pathfinder works. Badger setts are protected under the Badger Act 1992, but DEFRA do issue licences for the interference of badger setts for the purposes of forestry operations or to improve existing watercourses. However, every effort will be taken to avoid disturbing any setts located close to works or access routes and if necessary setts will be taped off to avoid accidental damage by machinery.

Certain SSSI units are also known to support rare species of flora and fauna. Those sites identified from data on the Forestry Commission GIS data base are shown in Table 5-5. When preparing the detailed work plans, checks will need to be made to establish whether any of these species are in close proximity to the works and whether further action needs to be taken, for example leaving key trees that are nesting sites for rare birds or taping off/translocating rare plant species.

Certain sites are important for deer lawns, in particular Queens Meadow and Aldridge Hill. During construction it is likely that deer would avoid the lawns, particularly at Queens Meadow due to disturbance from people and machinery.

Post Construction

None

Table 5-5: Potential site sensitivities in the vicinity of work sites

Site	SSSI Unit	Site Sensitivity
Aldridge Hill	502	Protect conifers designated as Hobby nest sites
Brockishill	401	Wild Service Tree recorded
Broomy/Amberslade	552	Hairy Violet, Brookweed, Corel necklace and Columbine recorded
Cranesmoor	131	Retiles – particular care needed when planning access routes Blackbog rush recorded
Etherise Gutter	460	Valuable plant communities along banks
Fletchers Thorns	499	Conifers support Firecrests
Frameheath	458	Marsh Gentian recorded
Gibbet Wood	100	Last known site of New Forest Cicada. No reports its presence for several years but need to be aware of its possible existence and sensitive management work carried out in recent years.
Hawkhill	464	A number of rarities recorded including Soft leaved sedge, Narrow leaved lungwort and Coral Necklace
Howen Bushes	59	Yellow centaury recorded
Long beech	112	Bog Orchid recorded
New Copse	460	Important populations of Pearl-bordered Fritillaries and Narrow leaved Lungwort
Parkhill	386	Skullcap recorded
Perrywood Ivy	569	Records of Common Twayblade & Narrow leaved lungwort
Pond Head	404	Ramsons & Wych Elm
Slufters Mires	81	Potentially important areas for reptiles
Vinney Ridge	500	Conifers support Firecrests

ii. Improved condition and restoration of SSSI habitats

As described in Chapter 2, it is hoped that the Pathfinder works will restore up to 4000 hectares of the New Forest SSSI into favourable condition through the removal of exotics and invasives, restoration of the original drainage system, restoration works in the A & O woodlands, scrub management and opening up areas to grazing through fence realignment. This will have significant benefits for the habitats (particularly wetland habitats) and ecology of the New Forest SSSI. Some more specific impacts are described below.

iii. Effect of restoring streams and the floodplain on macroinvertebrate communities

During construction

Where drains are being infilled there will be localised losses and disturbance to macroinvertebrate communities. It is thought that some species may be able to find their way back up through the gravel substrate as they have a tendency to burrow deep down into the substrate during dry periods. Disturbance to invertebrate communities close to the headwaters is more of a concern because these communities aid downstream colonisation and recruitment. Therefore in such areas the top layers of the substrate will be removed prior to drain infilling, temporarily stored on sheeting for a matter of hours and replaced back in stream in the hope that some fauna will have survived. Alternatively where a new stream course is being created some substrate will be transferred from the original channel to the new channel.

Post Construction

It is hoped that the wetland restoration measures for streams and ditches will ultimately benefit the macroinvertebrate community due to habitat improvement and increased diversity of habitat niches. Habitats that have become isolated from the main river due to canalisation and subsequent lack of seasonal flooding can support a much-impoverished invertebrate community (M. Thomas, July 2003). The species diversity in these areas tends to be restricted to those species that are able to tolerate a degree of desiccation, are capable of moving between aquatic habitats or have a very short aquatic stage to their life cycle. However there are some localised habitats within such areas that have been found to support rarities like the Mudsnail.

Differences between invertebrate communities of canalised reaches and sinuous reaches show that historic drainage work has had a detrimental effect on invertebrate communities. Furthermore many areas of SSSI habitat affected by historic drainage work are currently in unfavourable condition in terms of the invertebrate community.

Restoration work that can increase the heterogeneity within the channel will lead to the recovery of a more natural invertebrate community structure, through increases in some key taxa and decreases in others.

The Forestry Commission is currently supporting student projects looking at the effect of the works on macroinvertebrates and the speed and success of recolonisation. Monitoring work is also being carried out as part of the LIFE 3 project to look at the recovery of macroinvertebrate populations in restored stream sections.

iv. Effect of river restoration on fish species

During construction

Where stream courses need to be diverted or machinery is required to operate in the watercourse resulting in increased levels of turbidity a fish rescue will be conducted prior to the works using electro fishing techniques and fish returned to a safe reach in the watercourse further upstream or downstream.

The majority of New Forest streams support migratory sea trout populations. Thus in order to avoid disturbing sea trout or their spawning grounds, works will not take place between October and January. Sediment traps, for example heather bales, will also be used to prevent smothering of gravel substrates downstream.

Post Construction

It is anticipated that some changes in the density or distribution of fish numbers may occur as a result of river restoration works but the exact short term changes will not be known until Life 3 monitoring sites are revisited in 2006. Long term changes will not be ascertained for some years beyond.

It is known that the re-instatement of sinuous reaches will provide a mosaic of differing habitats able to support a more diverse fish population in terms of age and size range. Deep pools also provide refuges for larger trout and provide thermal refugia during hotter periods, organic deposition creates habitat for lamprey juveniles, backwaters act as shelters from spate conditions and riffle areas become more stable and therefore better for spawning and salmonid survival.

It is also hoped that in time the improved condition of certain reaches and restoration of meanders to provide additional river reaches will provide some additional spawning areas for salmonids and other fish species.

v. Effect of mire restoration on fish populations

In the summer months, low flows are frequently experienced in the headwaters and tributaries of the New Forest streams. Such events are one of the natural factors causing the large ‘natural’ variations inherent in migratory fish populations. It is hoped that the retention of precipitation through continued mire restoration will help to ameliorate the effects of low flows.

vi. Increased evaporation due to vegetation clearance and low summer flows

During construction

Southampton University and Forest Research are currently monitoring temperature variations in New Forest streams. Results to date show significant variations between water temperatures in open stream sections and shaded tree covered reaches. During the summer months, the clearance of stream side vegetation, particularly in Inclosures, would allow more sunlight to penetrate to the stream bed. This could increase water temperatures leading to greater evaporation rates and thus

more rapid drying out of streams with associated effects on fish and macroinvertebrates. It is considered that to date this has been a localised effect related to the scale of clearance, with plenty of shade still existing elsewhere along the river corridor and that the benefits of streamside clearance have outweighed any local disbenefits.

When planning future works consideration will be given to the vegetation balance along the stream and possibly preserving certain patches of overhanging scrub particularly where previously heavily shaded river corridors have been cleared and opened up.

Post construction

Forestry Commission is currently assisting with funding for student projects to ascertain what the precise effects are likely to be in relation to temperature variations and in-stream ecology.

vii. Restoration of trapped pre-Inclosure riverine and bog woodland

The process of enclosure combined with the effects of historic drainage and channel modification has resulted in the isolation and degradation of stands of alder and ash woodland that would have in the past bordered New Forest steams in a rich mosaic of wooded and open habitats. By restoring stream sections and reactivating the floodplain the full range of fluvial processes will be allowed to function within a physically, hydrologically and geomorphologically intact natural or near natural system. Periodic flooding of the riverine woodland stands is essential to restore the condition of SSSI Units containing riverine and bog woodland.

viii. Improvement of A & O Inclosure Plots

Works to A & O Inclosure plots, particularly thinning and pollarding of beech, removal of exotics and holly management will help to restore their condition and integrate them better into the original A & O woodland.

ix. Effects on breeding wader bird populations

Breeding wader bird surveys, including the survey carried out by the RSPB for the Life 3 Project, have noted the continuing and significant decline in breeding wader populations and their ranges in lowland Britain. Thus it is considered more important than ever to maintain and enhance habitats such as those within the New Forest which still support large numbers.

Population trends in the New Forest also note a decline in breeding wader numbers. Although no detailed studies have been carried out, there is the general presumption that human disturbance may be partly to blame, although there are a number of other factors, for example predation and loss of habitat, which also need to be considered. The PROGRESS Project is currently carrying out a detailed modelling study looking at a number of factors including the distribution of key bird species around the Forest and the feasibility of creating tranquil areas to minimise disturbance. Results and recommendations from this study are awaited.

It is hoped that the continued restoration of wetland habitats under Pathfinder will help to restore or provide new wetland habitats suitable for breeding snipe, curlews, redshank and lapwing.

x. Effects on deer lawns

There is some concern that the reinstatement of the stream back to its former course through Queen's Meadow could degrade the grazing on the deer lawn. This lawn supports good numbers of deer and is a popular site for members of the public to view deer. Provided any flood water drains off the lawn quickly enough the sward should not be affected (refer to 5.2vi) and a flush a nutrients from the flood water would potentially add to the productivity of the lawn, which otherwise cannot be artificially fertilised due to SSSI management agreements.

5.4 SOIL

i. Susceptibility of the soil to damage

In certain areas of the Forest, the waterlogged nature of some of the soils makes them susceptible to structural damage (compaction and erosion) when working with machinery. It is often not feasible to work with heavy machinery on soils during the late autumn, winter and early spring months (unless the ground is likely to be frozen for an appropriate length of time) which significantly limits the time period available to carry out certain restoration works. Thus in order to minimise damage to soil:

- In sensitive area works will be planned to avoid times of the year when soils are waterlogged (i.e. early winter to spring)
- Access routes will be carefully planned
- Appropriate machinery with low ground pressure loading will be utilised
- During summer if heavy rainfalls occur during the works, on sensitive open forest sites, machinery may be stood down
- Where necessary/feasible brash mats or geotextile matting will be used
- On particularly wet sites where large volumes of timber needs to be extracted sky cranes may be used (E.g. Cranesmoor)

These limitations require careful planning of the timing of the works and an appreciation that periods of poor weather can result in increased project costs.

ii. Damage from burning

Burning of brash is categorised as a severe burn due to the white ash layer left at the end of the burn. A burn of this intensity will destroy all organic matter to a depth of several centimetres and cause changes in the physical, chemical and biological

properties of the upper layers of mineral soil. Where soils are peaty particular care has to be taken to avoid ground fires developing.

Therefore on all sites where burning needs to take place, contractors are requested to keep the number of fire sites to the minimum. The scars from these sites can be visible for a few years until the vegetation recovers.

5.5 WATER

i. Management of Debris Dams

The management of debris dams along the New Forest steams has been a contentious issue over the years and to some extent is still debated particularly in relation to fishery and grazing interests. In the past their removal has been indiscriminate. There is also debate that the presence of cut timber and conifer brash in the floodplain can result in the formation of dams that perform differently from those formed from naturally derived native hardwood. However it is now recognised that the removal of naturally generated woody debris from debris dams or from within the floodplain can contribute to the unfavourable condition of the SAC priority features of alluvial forest.

It must also be recognised that each debris dam is unique. Thus a joint policy paper (currently under review) has been prepared by the Forestry Commission, Environment Agency and English Nature (Appendix M) to provide guidance on how to deal with debris dams. This policy will be adhered to in respect of the Pathfinder Works or until such time that the policy is amended.

ii. Effects on downstream flooding

A key aim of the works is to restore natural flooding to areas of floodplain within the Forest. This natural flooding is characterised by the retention of water in the floodplain. It is important that river restoration work does not increase the risk of flooding to downstream [residential] areas, either in frequency or severity. Therefore both the effect on flood peaks and phasing of tributaries need to be considered.

- *Effect of restoration works on flood peaks*

The restoration work include blocking drains, which will slow the hydrological response of the catchment as it will take longer for water to reach the main river channel. This will reduce the magnitude of flood peaks. In some areas the works will also raise the bed level of the river, where it has been heavily incised. This will reduce the capacity of the river, meaning that the river will spill onto the floodplain more frequently. Water will flow over the floodplain much more slowly than in the channel, and this will reduce the magnitude of flood peaks. Where meanders are re-introduced to reaches of river, this will increase the channel length, which will again slow the catchment response, and reduce the magnitude of flood peaks.

Individually, and together, each of these techniques will reduce the flood risk downstream of the project area.

Initial results from similar Life 3 works suggest that the restoration work has been successful in slowing the hydrological response of the Highland Water catchment, with increased travel time for flood peaks.

➢ *Effect of restoration works on phasing of tributaries*

Where works are taking place in catchments with multiple tributaries (e.g. Lymington Catchment) it will be important to ensure that by slowing the response of these subcatchments, their hydrological responses are not brought into phase to inadvertently producing one larger flood peak downstream. Future studies will need to address these issues on a site by site basis.

Modelling carried out for the Lymington Flood Strategy suggested that during moderate to high flood flows, when property is at risk, the effects of the restoration works would be negligible in preventing downstream flooding. However, the modelling did indicate that the effect of the works would be a benefit, albeit very small, rather than increasing flood risk.

Given the flashy nature of the rivers, flooding can last for a few hours or a few days. The extent and depth of the flooding will vary according to a number of different factors including:

- Antecedent conditions - if the ground is already saturated then run-off will be more rapid
- Size and topography of catchment supplying water for that area of flood plain
- Intensity and duration of rainfall
- Geomorphology of the floodplain
- Channel characteristics
- Local land-use

Flood modelling is important in advance of any significant river restoration works.

iii. Water Quality

During construction

Where works are taking place close to the watercourse there is a risk to water quality due to:

♦ Machinery working close to and within watercourses giving rise to turbidity and increased downstream sedimentation

♦ Posing a risk of oil spill/fuel leakage

Contractors will be expected to work in accordance with Environment Agency Pollution Prevention Guidance, notably “PPG05 – Works in, near or liable to affect watercourses” (Appendix N).

In order to reduce the effects of turbidity and sedimentation heather bales will be placed across the downstream end of the drain/stream being work to trap excess

sediment. Water will also be pumped around certain reaches when infill is taking place.

Oil spill booms will be placed across the watercourse to trap any accidental spill. Spill kits will also be on hand where machinery is working to mop up any accidental spills. Refuelling will take place well away from the water course either from a nearby depot or from a suitably sited fuel bowser. Fuel bowsers will be placed in accordance with Environment Agency Pollution Prevention Guidance "PPG 2: Above ground oil storage tanks" (Appendix N).

Post construction

During periods of summer low flow when natural productivity is increasing, precipitates and algal booms can be noticeable in some restored reaches. It is not entirely clear why this happens but it is thought it may be due in part to chemical constituents within the imported spoil oxidizing in the water. This may cause some reduction in water quality in localised reaches which could potentially compromise fish egg survival. However following a flush through during periods of heavy rainfall these precipitates disappear. It is thought that these blooms and precipitates will disappear entirely as the system settles down and is flushed through more fully during winter spates.

5.6 AIR QUALITY

During Construction

During construction there will be emissions to the air on certain sites due to:

- Exhaust emissions from machinery
- Controlled burning of residues from conifer clearance, exotics control and scrub management.

In order to minimise exhaust emission contractors will be expected to use well maintained plant and to switch off engines when idling.

Controlled burning of cut material produces smoke composed of small particles of ash, partly consumed fuel and liquid drops. Smoke is of concern when it drifts across roads reducing driver visibility or paths and rides affecting recreational users. Therefore controlled burning is carried out using techniques to minimise smoke nuisance, notably by:

- Minimising the soil content in heaps
- Allowing time for cut material to dry adequately but still ensuring the surrounding vegetation is not dry enough to pose a fire risk
- Burning on days when the wind direction is appropriate to the site and winds are an ideal speed (ground speeds of between 13kph (8mph) and 16kdp (10mph) are ideal for good smoke dispersion)
- Placing warning signs on roads where there is any risk of smoke drift.
- Notifying the Fire brigade of the intention to burn

Rhizina undulata, a type of fungus that can take advantage of burn sites and affect surrounding trees has not presented a problem in the New Forest to date.

Post construction

No impact

5.7 CLIMATIC FACTORS

i. Improved robustness against climate change

Climate is changing more rapidly now than at any time in the past ten thousand years. A key factor in this warming is considered to be due anthropogenic activities, particularly greenhouse gas emissions, because a large part of the warming cannot be explained by natural climatic variations alone. The UK Climate Impacts Programme (UKCIP) has been carrying out in depth modelling and research into the possible effects of climate change in the UK, based on different climate change scenarios (Hulme et al, 2002). The general climatic changes are summarised in Table 5-6.

Table 5-6: General Climatic Changes

Climate Variable	UKCIP02 Scenario	Relative Confidence Level
Temperature	Annual warming by the 2080's of between 1 ^{o}C - 5 ^{o}C depending on region and scenario	High
	Greatest summer warming in the south-east	High
	Years as warm as 1999 become very common	High
	Thermal growing season increases everywhere with largest increases in the south-east	High
Precipitation	Generally wetter winters for the whole UK	High
	Precipitation intensity increases in winter	High
	Substantially drier summer for the whole UK	Medium
	Summers as dry as 1995 become very common	Medium
Humidity	Specific humidity increases throughout the year	High
	Relative humidity decreases in summer	Medium
Snowfall	Total decreases significantly everywhere	High

Source: UKCIP

The MONARCH project, which is part of the UKCIP programme, has attempted to evaluate the effects of climate change on nature conservation (Harrison et al, 2001). Monarch provides climatic bioclassifications for the UK and considers changes for various scenarios based upon different levels of atmospheric CO_2. The majority of the New Forest lies within Bioclass 19, and the climate changes predicted for this class are shown in Table 5-7.

Table 5-7: Climate Characterisation of Class 19 for UKCIP98 Climate Change Scenarios (located in southern and eastern England)

Climatic Variables	UKCIP Climate Change Scenarios							
	2020LO	2020ML	2020MH	2020HI	2050LO	2050ML	2050MH	2050HI
Summer T_{mean}	+0.6°C	+1.1 °C	+1.3 °C	+1.5 °C	+0.9 °C	+1.5 °C	+2.1 °C	+2.5 °C
Winter T_{mean}	+0.5 °C	+0.8 °C	+1.3 °C	+1.4 °C	+0.9 °C	+1.5 °C	+2.0 °C	+2.3 °C
Summer Rain	-5.6%	-5.6%	-5.6%	-5.6%	-5.6%	-5.6%	-16.7%	-16.7%
Winter Rain	+4.0%	+4.0%	+8.0%	+8.0%	+4.0%	+8.0%	+8.0%	+12.0%
Summer PET	2.7%	5.4%	8.1%	8.1%	5.4%	8.1%	13.5%	16.2%
Winter PET	0.0	0.0	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%
Annual Windsp	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Windsp	0.0	0.0	0.0	1.7%	0.0	1.7%	1.7%	1.7%

T_{mean} is mean air temperature, Rain is rainfall, PET is Potential evapotranspiration, Windsp is mean monthly windspeed. LO, MH, HI refers to different scenarios of CO2 concentrations.

The predicted climate changes have potentially significant consequences for the New Forest wetlands, for example:

- Increase in winter flooding and erosion potential
- Increasing frequency of summer drying
- Possible increase in levels of invasion by alien species, pests & diseases
- Change in hydrological regime
- Changes in water quality due to increased temperatures resulting in lower levels of available oxygen increased biological respiration rates leading to reduced levels of dissolved oxygen
- Changes in fish and macroinvertebrate populations
- Changes in species diversity
- Changes in species distribution including that of wetland waders
- Reduction in drought intolerant species such as Beech
- Rising sea levels

Therefore it is important that the wetland habitats and the hydrological regimes that support them are restored to a favourable condition to allow them the opportunity to withstand and deal more effectively with climatic extremes.

The Forestry Commission is a member of the South East Climate Change Partnership whose mission is to investigate, inform and advise of the threats and opportunities arising from the impacts of climate change in South East England and to promote adaptive planning in the region.

5.8 ARCHAEOLOGICAL IMPACTS

i. Protection of archaeological sites

The Forestry Commission is statutorily obliged to consult with English Heritage and the County Archaeologist over any risks to archaeological sites and their management in relation to any works being carried out. Where the archaeological potential of the site is high and more needs to be known, field evaluations are carried out by professional archaeologists.

In addition, Hampshire Field Club has a considerable database of non-statutory sites with their own categorisation of importance and vulnerability. However, this data is not publicly available or routinely shared with other statutory bodies. Information held by the Hampshire Field is taken into consideration when conducting the works and where possible the sites marked out in advance of the works.

It is recognised that there are a large number of archaeological sites within the Forest that are unknown and that are potentially located within areas proposed for Pathfinder SSSI restoration works. In such areas (for example Pitts Wood, Queens Meadow, Fletchers Water) where there is high archaeological potential and earthworks need to be carried out, a watching brief will be undertaken by a suitably qualified archaeologist. Studies are currently underway to identify the archaeological potential of Pathfinder sites.

ii. Scope to enhance existing Scheduled Ancient Monuments (SAM)

The lower end Fletcher's Water was dug through the middle of the site of Queen Bower, a former hunting lodge which is now a SAM. If this channel is infilled there may be opportunities to restore or enhance this site and scope for this is currently under investigation.

5.9 LANDSCAPE IMPACTS & MITIGATION

i. Landscape changes

Permanent landscape changes will take place through tree felling, scrub removal and modifications to the river channel on a localised scale. Removal of trees can be an emotive subject among local residents and visitors to the Forest.

Earth works and new cleared areas can be visually stark to begin with provoking some public outcry but once areas have started to settle down and revegetate the areas gradually restore visually over a few years.

Although reseeding could be carried out to repair the visual scars from soil disturbance more quickly, it tends to be avoided where possible to reduce the risk of introducing non-native genetic populations. Experience has shown that total vegetation cover is usually achieved within 2-3 years although it is likely to take longer for a climax sward to re-establish.

ii. Landscape features and exotics

Certain isolated stands of trees, for example stands of mature pines, can in some areas become key landscape features in their own right, even though from an ecological perspective their removal would be desirable. Where this is the case, policy allows for the retention of the trees if they form a significant landscape feature and each site has been and will continue to be considered on a site by site basis. Studies were carried out in the 1970's reviewing the significance of Scots Pine on the open forest as a landscape feature. These reports[2] still provide useful reference for current day site planning

iii. "Forest Furniture"

Where "Forest furniture" such as bridges, signs or swing gates need to be replaced it is important that their aesthetic appearance fits into the landscape of the Forest and follow Forest guidelines in terms of appearance. Verderers' approvals, along with consents from other relevant bodies, are required for certain items on the open forest.

5.10 SUMMARY OF IMPACTS

The relevance of each of the impacts noted above is summarised in Table 5-8 in accordance with the method of assessment highlighted in section 5.1.

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Table 5-8: Summary of Impacts

Impact	Human Beings		Flora & Fauna		Soil		Water		Air		Climate		Material Assets		Landscape	
	During Works	**Post Works**	**During works**	**Post works**	**During works**	**Post works**	**During works**	**Post works**	**During works**	**Post works**	**During works**	**Post works**	**During works**	**Post Works**	**During works**	**Post works**
Toxicity of sprays	Minor Negative Temporary	-	Minor Negative Temporary	-	Negligible	-	Negligible	-	Negligible	-	-	-	-	-	-	-
Noise disturbance	Minor - Moderate Negative Temporary	-	Moderate Negative Temporary	-	-	-	-	-	-	-	-	-	-	-	-	-
Restricted access to timber harvesting sites	Minor-moderate Negative Temporary	Minor-moderate Negative Long term	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Restrictions to recreation	Moderate Negative Temporary	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Changes or alterations to stream crossings	Moderate Negative Temporary	Moderate Positive Long-term + Minor Negative Long term	-	-	-	-	-	-	-	-	-	-	-	-	-	Minor Neutral Long term
Improvements to Grazing	Minor Negative Temporary	Moderate Positive Long Term	-	Moderate-Major Positive Long term	-	-	-	-	-	-	-	-	-	-	-	Minor Neutral Long term
Maintenance of drift lines	Negligible	Negligible	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Improved stock safety	Minor Negative Temporary	Moderate Positive Long term	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Socio economic benefits	Moderate positive temporary	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compliance with other Policies and Plans	-	High Positive Long term	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Disturbance to flora & fauna	-	-	Moderate-High Negative Temporary	Minor Positive Long term	-	-	-	-	-	-	-	-	-	-	-	-
Improved condition & restoration of SSSI habitats	-	-	-	Major Positive Long term	-	Major Positive Long term	-	Major Positive Long term	-	-	-	-	-	-	-	Moderate Neutral Long term
Effect of restoring streams & floodplain on macroinvertebrate communities	-	-	Moderate-High Negative Temporary	Moderate-Major Positive Long term	-	-	-	-	-	-	-	-	-	-	-	-
Effect of river restoration on fish species	-	-	Minor Negative Temporary	Moderate – Major Positive Long term	-	-	-	-	-	-	-	-	-	-	-	-

Impact	Human Beings		Flora & Fauna		Soil		Water		Air		Climate		Material Assets		Landscape	
	During Works	Post Works	During works	Post works	During works	Post works	During works	Post works	During works	Post works	During works	Post works	During works	Post Works	During works	Post works
Effect of mire restoration on fish species	-	-	-	Minor-Moderate Positive Long term	-	-	-	-	-	-	-	-	-	-	-	-
Increased evaporation due to vegetation clearance and low summer flows	-	-	-	Negligible - Minor moderate Negative Medium - Long term	-	-	-	-	-	-	-	-	-	-	-	-
Restoration of trapped pre-Inclosure riverine and bog woodland	-	-	-	Major Positive Long term	-	-	-	-	-	-	-	-	-	-	-	
Improvement of A & O Inclosure Plots	-	-	-	Moderate – Major Positive Long term	-	-	-	-	-	-	-	-	-	-	-	Moderate Positive Long term
Effects on breeding wader bird populations	-	-	-	Moderate – Major Positive Long term	-	-	-	-	-	-	-	-	-	-	-	-
Susceptibility of the soil to damage	-	-	-	-	Minor – Moderate Negative Short term	-	-	-	-	-	-	-	-	-	-	-
Damage from burning	-	-	-	-	Minor Negative Short term	-	-	-	-	-	-	-	-	-	Minor Negative Short term	Minor Negative Short term
Management of debris dams	-	-	-	Moderate to Major Positve long term	-	-	-	Moderate to Major Positve long term	-	-	-	-	-	-	Minor Neutral Long term	Minor Neutral Long term
Effects on down stream flooding	-	Moderate positive long term	-	-	-	-	-	Minor-moderate Positive Long term								
Water Quality	-	-	-	-	-	-	Minor Negative Short term	Minor Negative Short term	-	-	-	-	-	-	Minor Negative Temporary	Minor Negative Short term
Air Quality	-	-	-	-	-	-	-	-	Minor Negative Temporary	-	-	-	-	-	-	-
Improved robustness against climate change	-	-	-	-	-	-	-	-	-	-	-	Moderate Positive long term	-	-	-	-
Protection of archaeological sites	-	-	-	-	-	-	-	-	-	-	-	-	Minor-moderate Negative Temporary – long term	-	-	-
Scope to enhance existing Scheduled Ancient Monuments	-	-	-	-	-	-	-	-	-	-	-	-	-	Moderate - Major Positive Long term	-	-
Landscape changes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Moderate Negative Short term	Moderate Neutral Long term

Impact	Human Beings		Flora & Fauna		Soil		Water		Air		Climate		Material Assets		Landscape	
	During Works	**Post Works**	**During works**	**Post works**	**During works**	**Post works**	**During works**	**Post works**	**During works**	**Post works**	**During works**	**Post works**	**During works**	**Post Works**	**During works**	**Post works**
Landscape features and exotics	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Negligible
Forest furniture	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Minor Neutral Long term

6. CONSULTATION

Consultation has been key to progressing wetland restoration works to date through Life 3 and will continue to be so for the Pathfinder works. Figure 6.1 shows how the consultation process fits into the Pathfinder Project in terms of progressing the works.

On more sensitive sites, site visits are conducted with key consultees prior to drawing up a detailed work plan in order to identify any key sensitivities that need to be taken account of in the plan. Once a work plan has been drawn up it is sent to consultees for approval before being sent on formally to statutory authorities to obtain any necessary consents.

Key consultees include:

- Environment Agency
- Forestry Commission Staff including Foresters & Keepers
- Verderers
- English Nature
- Commoners' Defence Association

In addition relevant information regarding works is sent to:

- New Forest Association
- National Park Authority
- Hampshire Wildlife Trust

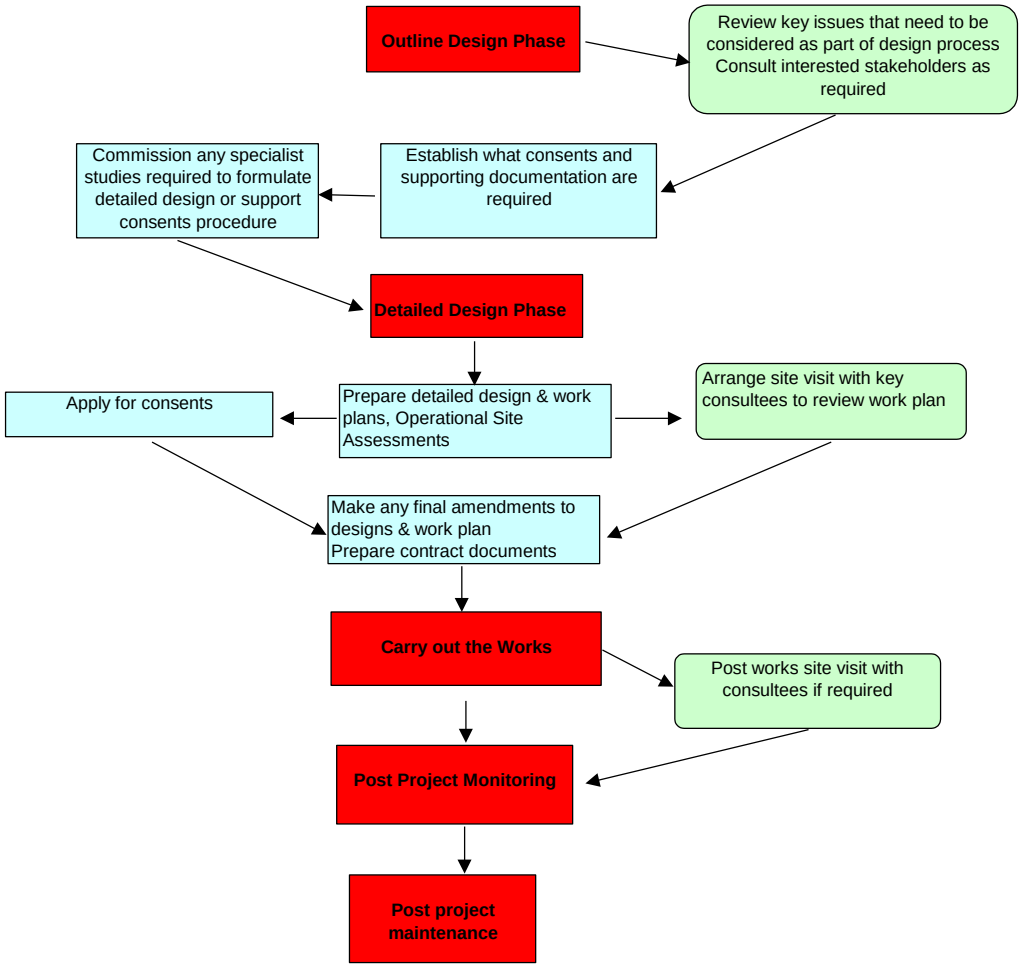
Works concerning the open forest are also discussed and debated at the Open Forest Advisory Committee (OFAC)

Where works require planning consent under the Town & Country Planning Act, the National Park Authority will be consulted in their role as statutory planning authority.

In addition, the Water Basin Management Forum, which comprises of a wide range of groups and individuals with an interest in wetland restoration, was key to progressing and steering the Life 3 works (see Appendix O). It is intended that this group will continue to meet once a year. Pathfinder sites will be presented both in terms of progress and intended future sites for discussion at this Forum.

A key part of the Hampshire Rural Pathfinder Project is evaluating methods to streamline consents and reviewing the role of consultation. The findings of this element of the Project are due to be reported on later in 2006. Any recommendations or pilot actions will be incorporated in to the consultation and planning process as required.

FIGURE 6.1: CONSENT & CONSULTATION PROCESS



GLOSSARY OF TECHNICAL TERMS

Abstraction The removal of water from any source i.e. groundwater or river, either permanently or temporarily.

Adjacent Commons Privately owned common land which as brought within the Perambulation of the New Forest by the New Forest Act of 1964. Sometimes described as the "manorial" commons.

Agisters Officers in charge of animals taken in for grazing. The Agisters of the New Forest are employed by the Verderers mainly to supervise the commoners' animals.

Alluvial woodland/riverine woodland Woodland growing on the floodplain

Ancient and Ornamental Woodlands The natural woodland on the Crown land in the New Forest, which is of great antiquity.

Aquifer A water-bearing stratum situated below ground level.

Biodiversity The diversity of plant and animal life in a given area.

Catchment Abstraction management Strategies (CAMS) Strategies for the management of water resources at a local level. Catchment Abstraction Management Strategies make more information on water resources and licensing practice publicly available and allow the balance between the needs of abstractors, other water users and the aquatic environment to be considered in consultation with the local community and interested parties.

Catchment Flood Management Plans (CFMPs) Catchment Flood Management Plans are strategic planning tools through which the Environment Agency seeks to work with other key decision –makers within a river catchment to identify and agree policies for sustainable food risk management.

Commoners Those entitled to exercise various rights on common land.

Coppicing The regular (6 to 30 years) cutting at or near ground level of broadleaved trees to stimulate regrowth of young and vigorous shoots from the stump.

Cottid Fish with two dorsal fins

CROW Act The Countryside and Rights of Way Act 2000 (also known as CROW) will extend the public's ability to enjoy the countryside whilst also providing safeguards for landowners and occupiers. It will create a new statutory right of access to open country and registered common land, modernise the rights of way system, give greater protection to Sites of Special Scientific Interest (SSSIs), provide better management arrangements for Areas of Outstanding Natural Beauty (AONBs), and strengthen wildlife enforcement legislation.

Culvert Closed channel-carrying water under a road, canal etc.

Cumec A measure of flow equating to one metre cubed per second ($1m^3/s$)

Deputy Surveyor The Forestry Commission's senior officer in the New Forest

Drifts The rounding up of animals on horseback and on foot

Ephemeral Seasonal or periodic

Evaporation The process where liquid water turns to vapour

Evapotranspiration The loss of water to the atmosphere as a result of the combination of evaporation and the transpiration of plants

Exotic species Non native species to the UK which has been introduced into the New Forest by man

Favourable condition (habitat) When a habitat's natural range and the areas it covers within that range are stable and increase, and the species structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future

Floodplain The low relief area of valley floor adjacent to a river that is periodically inundated by floodwater.

Fluvial Of, or occurring in, a river.

Forb A non-woody flowering plant that is not a grass.

Forest Laws The laws which governed medieval hunting forests.

Floodplain. Land adjacent to a river over which water flows in time of flood or would flow if the river had not been altered by human intervention

Heritage asset Any place with some heritage value including Scheduled Monuments, Listed Buildings, Registered Parks and Gardens and known areas of archaeology.

Humic Peaty

Hydraulic model (or computer modelling) A computer model built for a given river system, and used to simulate and predict flows, flow conditions (hydraulics), tide conditions and river responses to physical changes e.g. in precipitation and channel shape.

Inclosures Crown land in the New Forest from which the commoners' animals may be excluded under the New Forest Acts for the growing of trees. The word is an older form of "enclosure".

Indicative Fluvial Floodplain The area that is anticipated to be at risk of flooding from a fluvial water level with a 1% chance of occurring. This is based on hydraulic modelling and observed events, and is defined by the Environment Agency.

Infrastructure Relating to the transport network including roads, bridge and railway lines.

Invasive Species not usually found in the New Forest but which has colonised over the years and is spreading in distribution

Invertebrate Any animal that lacks a vertebral column, or backbone

Listed Building The Secretary of State for Culture, Media and Sport is required to compile lists of buildings of special architectural or historic interest; these are known more generally as 'listed buildings'. The definition of 'listed building' is fairly wide and the term 'building' may include a wide range of structures including bridges, milestones and follies. Generally, these buildings will have survived without too much alteration and be good examples of a certain period or type of architecture.

Macroinvertebrate The term macroinvertebrates is traditionally used to refer to aquatic invertebrates including insects (e.g. larval Ephemeroptera and Trichoptera), crustaceans (e.g. amphipods), molluscs (e.g. aquatic snails) and worms (e.g. Platyhelminthes), which inhabit a river channel, pond, lake, wetland or ocean. Historically, their abundance and diversity have been used as an indicator of ecosystem health and of local biodiversity. They are a key component of the food chain.

Macrophyte Larger plants, typically including flowering plants, mosses and larger algae but not including single-celled phytoplankton or diatoms

Main river The term 'main river' is a statutory designation shown on maps held by DEFRA. These indicate which rivers and estuaries are classified as 'main river' and which are not. The Environment Agency's powers vary depending on whether the river is 'main river' or 'ordinary watercourse'.

Mire An area of marshy or waterlogged ground

Nick-point Point on the long profile of a stream where the gradient is broken by a sudden drop in elevation. Nickpoints are the locations of rapids and waterfalls and migrate upstream in response to erosion.

Open Forest. Crown land in the New Forest over which common rights may be exercised.

Ordinary Watercourse A watercourse which is not classified as Main River

Oxidation Chemical reaction which happens when oxygen dissolved in water reacts with certain rock minerals, especially iron to form oxides and hydroxides. Often manifests as yellow or brown staining.

Pannage Season The time of year when acorns drop and when pigs may be turned-out to eat them.

Perambulation Formerly the boundary of the royal hunting forest. The current Perambulation was defined by the New Forest Act 1964. Common land within it (excluding Minstead Manor) is subject to the powers and duties of the Verderers.

Peak flow The highest discharge achieved during a flood event.

Pollarding The regular (6-30 years) cutting of broadleaved trees at a height above the reach of large herbivores to stimulate regrowth of young and vigorous shoots

Pest Non native species to the New Forest which is spreading rapidly and is difficult to eradication or control

Poaching Erosion or damage to the soil structure by livestock

Ramsar An area that has been designated a Wetland of International Importance as defined by the Ramsar Convention of 1971, designed to promote wetlands and foster their wise use.

River basin Sometimes known as a river catchment, a "river basin" is the area of land from which all surface run-off flows through a sequence of streams, rivers and, possibly, freshwater lochs into the sea at a single river mouth, estuary or delta

Runoff Water that flows over the surface of the land rather than infiltrating into the soil. .

Scheduled Ancient Monument Archaeological remains scheduled under the Ancient Monuments and Archaeological Areas Act 1979 and afforded special protection.

Seepage step A zone in the hillside where water slows oozes out of the ground demarcated by a step or small scarp.

Site of Special Scientific Interest (SSSI) A site of national importance designated under the Wildlife and Countryside Act 1981.

SPA (pSPAs and cSPAs) Special Protection Area. Site designated under the Birds Directive (79/409/EEC) for the conservation of wild birds.Together with SACs, they form part of the Natura 2000 network of sites. All sites are SSSIs. Also includes possible and candidate SPAs.

Special Area of Conservation Site designated under the Habitats Directive (92/43/EEC) for the conservation of natural habitats and of wild fauna and flora. Together with SPAs will form the Natura 2000 network of sites. All sites are SSSIs. Also includes proposed and candidate SACs.

Sward Expanse of short grass

Syncline A structural downfold in the Earth’s crust where the younger rocks occupy the centre and the older rocks may be exposed by erosion on the flanks.

Throughflow The movement of water through the soil as opposed to over the surface

Tributary A stream or river which feeds into a larger one.

Watershed An area of land that drains downslope to the lowest point. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers, which become progressively larger as the water moves on downstream, eventually reaching an estuary and the sea.

Water table Top surface of the saturated zone within the aquifer.

Wetland An area of low-lying land where the water table is at or near the surface for most of the time, leading to characteristic habitats.

Verderers The statutory body which administers and protects the common rights in the New Forest and the amenity of the Forest.

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