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1 River Enrick integrated catchment management plan

The River Enrick catchment is located in the Highlands of Scotland some 15 km SW of Inverness (Fig.1.1). The area has a valuable natural heritage with a diversity of environments including wild mountain tops, sheltered lower glens and numerous water bodies. There are also many good examples of upland habitats, communities and species and the river is one of the main salmon spawning and juvenile nurseries in the Ness catchment. The area is enjoyed and valued by the local community with farming, forestry, tourism and recreation providing opportunities for local businesses.

A series of major floods in the late 1980s and throughout the 1990s caused serious damage to the River Enrick channel as well as adjacent properties and the local infrastructure. The floods initiated action by the community to investigate the causes and to develop proposals for improved management. An integrated management plan was proposed linking all parts of the catchment and taking into account the aspirations of the local community, the management plans of land owners, the policies of The Highland Council and other agencies and the range of conservation interests. The final product would include both short term and long term aims and planning of how they should be implemented.

Fig.1.1 Location of the River Enrick catchment

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2 Integrated catchment management plans

2.1 General

An integrated catchment management plan (ICMP) is an accepted method of translating a range of aims and principles into action. The plan should describe the vision for the short and long term futures of the catchment, identify current problems and propose actions which may be taken to resolve them. ICMPs comprise a consultation report and an action plan which together:

- Assess the catchment resources, uses and activities;
- Consult widely on issues to be tackled;
- Establish a long term vision for the catchment;
- Use effective planning to prevent future environmental damage;
- Provide lasting solutions to environmental problems;
- Promote sustainable development so that resources can be used but not depleted.

ICMPs do not have any formal status in terms of statutory planning regulations and control. They therefore need to be developed in partnership with the stakeholders and within the Local Authority's Structure Plan and Local Plan. However ICMPs are

not an amalgamation of existing policies, they should be a means of planning for management actions by identifying the individual aims of all stakeholders and bringing together a collective view rather than having many individual views.

The development of an ICMP should be carried out in close consultation with the land owners, community and agencies involved to develop a strong feeling of ownership. ICMPs should assess the catchment resources, uses and activities and identify which areas are sensitive to certain uses and which are vulnerable. The integration of the plan should enable links to be made between sources, of say pollution, and the affected areas. This should not only identify the links but also establish the strength of the links and whether barriers have been created or need to be created.

Development of an ICMP involves two phases:

Phase I: consultation

1. Set up the ICMP Group
2. Consult on the priorities of the communities including a first public meeting
3. Identify and describe the current and future catchment uses
4. Identify environmental objectives and standards for individual catchment uses
5. Identify catchment issues and options
6. Consult with the Group
7. Undertake external consultation through a second public meeting

Phase II: action plan

1. Produce a draft ICMP
2. Undertake consultation on the draft with the Group
3. Undertake external consultation by distributing the draft and holding a third public meeting
4. Produce the final ICMP
5. Monitor and review the ICMP

2.2 Development of the River Enrick ICMP

For the River Enrick the key aims in working towards a successful catchment management plan are:

- To ensure that all new developments within the Enrick catchment meet the current needs without compromising future uses of the water environment;
- To protect the high water quality standards which exist throughout the catchment;
- To ensure, where possible, that the quantity of water in the river, its tributaries, lochs and wetlands is sufficient to sustain the diversity of habitats and their associated flora and fauna particularly on designated sites;
- To reduce the threat of very large floods which cause serious damage to properties and the local infrastructure;

- To provide appropriate and effective protection of the river channel, riparian areas and neighbouring buildings and other facilities;
- To maintain and enhance the diversity of the natural river features, river corridor and shoreline habitats and their associated flora and fauna;
- To assist the fisheries interests on the river and loch to ensure that appropriate habitats are provided and the migratory routes are not blocked;
- To encourage appropriate access to the river and loch for recreation;
- To promote a partnership approach to implementing the ICMP.

These aims form the basic aspirations of the stakeholders around which the ICMP will be developed.

Q1 ► Views are sought on whether this is the full list of stakeholder aspirations

2.3 Consultation report

This report details the outcome of the consultation phase of the project. The aim is to gain an overall understanding of the catchment issues which stakeholders consider important. This consultation phase included the following:

- Summarising existing management plans for the catchment and the potential effects on the catchment;
- Carrying out surveys of features within the catchment and the issues related to these features;
- Consulting with the community through public meetings, a questionnaire and individual meetings to list the concerns and aspirations of the people who live in the catchment.

The report includes a number of questions which ask whether the issues are described correctly. Responses are requested so please write with your views to: Dr R C Johnson, Mountain Environments, Spinningdale, Stirling Road, Callander FK17 8LE. Or email to: rcjohnson@mountain-environments.co.uk.

Responses should be returned by 24th December 2001. Unless you request otherwise all responses will be made available to others.

3 Existing plans for the area

The River Enrick catchment management plan should be linked to other plans already in existence including The Highland Council Structure Plan and Local Plan, management plans of designated areas and the Forest Enterprise Design Plan.

3.1 Highland Council Structure Plan

The current Highland Council Structure Plan (The Highland Council, 2001) for the region became operative in March 2001. The Plan recognises the environment as a key strength of the Highlands and stresses the need for appropriate planning and management of the rural areas. Much of the policy detailed in the document is of direct relevance to the development and support of the River Enrick catchment management plan. Of particular relevance are the references to the natural environment, nature conservation, forestry and fisheries.

In the Structure Plan the natural environment of the Highlands is described as being of importance to the area while forestry is a significant land use and makes a valuable contribution to the rural economy. It is frequently stated in the document that communities will benefit from participating in decisions that affect them. Policies have therefore been developed to integrate the protection of the environment with the development of strong vibrant communities.

The high quality of the natural environment is a key element in the region's identity. The Council aims to build on and strengthen this quality by protecting the wildlife resource and realising development potential for the benefit of the local communities. The landscape and scenery of the Highlands is a valuable resource of the region and an important factor in attracting tourists to the area. The tourism attractions are the wildness, openness and loneliness of the area, characteristics which are becoming increasingly scarce on a national perspective. Landscape can however change, in particular through land management practices and erosion pressure from visitors. Protection of the environment and its biodiversity should not just concentrate on designated sites but all development proposals should be evaluated for their implications for nature conservation.

The Council's Indicative Forest Strategy has been developed to guide and influence future planting and felling. The guidance aims to encourage the development of a diverse, multi purpose forest resource through sustainable forest management. Particular attention is given to any impacts of forestry on farming, recreation, roads and bridges, water supply intakes and catchments, land drainage and fishing. There is also support for the conservation and expansion of native woodlands in the region through long term restoration and regeneration projects. In addition community and amenity woodlands are being encouraged.

Game fishing in the region is an important income generator for estates, hotels, bed and breakfast establishments and a range of other businesses. Recent declining trends in catches have focussed attention on a number of issues such as river and catchment management where positive management has many benefits in addition to enhancing the natural fisheries resource. For example the nature conservation value may be enhanced, the scenic quality improved and recreational access developed. Positive management may include encouraging semi-natural vegetation along river corridors, avoiding the canalisation of the river course and active

engineering through the construction of croys and pools and placement of large boulders. This management is based around the voluntary adoption of best practices such as those which have been developed for the River Spey.

River engineering works should be designed to avoid significant detrimental impacts on other interests. Work carried out requires planning permission and the Council will work with other agencies to ensure schemes are properly designed and professionally carried out.

The main natural hazard in the Enrick catchment is flooding from surface water sources. The Council believes flooding to be a localised issue and has adopted a policy for new developments to be assessed if there is a significant risk of flooding. The Council has a statutory responsibility in respect of flood protection for non-agricultural land. Flood appraisal groups in each Council area are recommended by the NPPG7 which will bring together all agencies with responsibilities for flood management. The Council intends establishing a group for the area although its focus will initially be within the Inverness area. The Council also supports the inclusion of flood management within Integrated Catchment Management Plans.

3.2 Inverness Local Plan

The Inverness Local Plan, which includes Drumnadrochit and Glen Urquhart, is currently in draft form as a consultative document. In the Plan Drumnadrochit is described as a main service and route centre. It has a key position beside Loch Ness and close to Inverness. The population of the village has increased steadily over recent years as local services have built up and the Plan states that “substantial further land is required for housing”. The economy draws heavily on the tourist trade with particular attractions being Glen Urquhart and Urquhart Castle. Drumnadrochit is said to be ideal placed to develop as a base for outdoor pursuits.

3.3 Forest Enterprise Design Plan

The Scottish Forest Strategy 2000 and the Forest Enterprise Corporate Plan outline strategies for managing the forest resource. The Forest Enterprise Design Plans relate these to the local level outlining in practical terms how the strategies will be implemented on the ground. The Design Plan for the Enrick area is based around the fact that the forests are planted on steep visible slopes. The management objectives for different resources linked to the forest are:

Objective 1: Create a forest which blends in and enhances the landscape achieved by:

- a. identifying core areas for riparian management, native woodlands and open spaces
- b. undertaking small scale felling and thinning to create transition zones between neighbouring land and the forest

Objective 2: Safeguard private water supplies, habitats and natural watercourses by:

- a. surveying private water supplies and using alternatives to clearfell
- b. improving riparian zones with open spaces and broadleaves
- c. carrying out minimal ground preparation, and use mounding where possible
- d. maintaining roadside drains and culverts
- e. carrying out sensitive harvesting

Objective 3: Maintain the soil structure and fertility by carrying out the following:

- a. increasing the proportion of alternatives to clearfell
- b. minimising the areas of cultivation and using mounding where possible
- c. using whole tree harvesting on winch sites
- d. using horses for timber extraction in community woodland and sensitive sites
- e. encouraging natural regeneration of native species

Objective 4: Involve the community in developing a mutually satisfactory design by:

- a. involving local people in the forest design plan and provide good two way communication
- b. encouraging educational use of the forest
- c. expanding facilities to encourage visitors
- d. encouraging local initiatives

Objective 5: Protect, create and expand habitats to encourage native flora and fauna by:

- a. promoting the regeneration of native woodland by reducing deer numbers, ejecting sheep and focussing on semi natural remnants for early restoration
- b. restructuring the forest by felling carefully designed areas
- c. creating woodland pasture

Objective 6: Maintain the status quo or improve facilities for recreation by:

- a. creating new paths with external funding, expand new cycle tracks and provide educational walks and more car parking
- b. providing access points in fences
- c. regarding all forest roads as recreational routes
- d. encouraging community initiatives
- e. carrying out risk assessments before forest operations
- f. providing information points

Objective 7: Generate economically viable production of timber by:

- a. using flexible felling dates to allow market placement
- b. marketing non-timber products

Objective 8: Safeguard all archaeological sites and enhance their value to the public by:

- a. removing vegetation where appropriate
- b. carrying out site inspections and reporting of suspected sites

- c. maintaining photographic records of sites

3.4 Management of wildlife and conservation

The management of wildlife and the conservation interests within the Enrick catchment is achieved through designated areas and also through voluntary codes of conduct.

Designated areas within the catchment include three Sites of Special Scientific Interest (SSSI), one also being a Special Protected Area (SPA) and another a candidate Special Area of Conservation (cSAC) and one Nature Reserve (Fig.3.1). Although these sites are designated for their special qualities the management plans are relevant to other parts of the catchment where issues need to be addressed. The management plans for these areas are summarised below.

a Gartally Limestone Quarries SSSI

The site is on the northern side of the Enrick catchment just above Upper Gartally Farm. It comprises five small disused quarries which were worked in the past for extracting limestone. The site forms the largest area of limestone within the group of metamorphic rocks known as the Moines and is also the largest exposure of limestone between the Great Glen and the NW coast of Scotland. A large proportion of the purest material has been worked out however there remains material containing unusual assemblages of minerals and the site is still of high importance for geological studies. The site is open and accessible but there has been some damage caused by dumping and by the collection of geological specimens. The management of the site includes no further dumping of waste and tree planting should not encroach within 10 metres of the exposures.

b Urquhart Bay Woods SSSI

The Urquhart Bay Woods SSSI is located on the delta of the rivers Enrick and Coiltie where they flow into Loch Ness. SSSI designation was given to the site because of its swamp and floodplain alderwood habitats. Under the EU Habitats Directive floodplain alder and ash wood is recognised as a Priority Habitat. The Scottish Executive proposed the site to the EU as a candidate Special Area of Conservation (cSAC) in December 2000. It is a core of ancient woodland that has survived agricultural reclamation because of the poor soils and the regular inundation by flood waters. Some excavation of the channels occurs to try and reduce the areas of inundation and to ensure the migration of salmon. The site has been invaded by non-native plant species including Japanese knotweed, lupin, white butterbur, snowberry and sycamore. There is some recreational use of the woods including walking, horseriding and access for fishing in Loch Ness. There is also some winter grazing on the area.

Fig.3.1 Designated sites within the catchment

In 1993 an advisory report was prepared by the SNH Earth Science Branch on river management within the Urquhart Bay woods. The authors consulted with local land owners and the Ness District Fisheries Board. The main issues were identified as:

- There is a need to protect agricultural land from both the Rivers Enrick and Coiltie but there is also a need to maintain the dynamic nature of the area and the diverse habitats of abandoned channels including the well drained stony ground and poorly drained swampy environments;
- Upstream river management can have an adverse impact on the rivers, in particular the increased sediment deposited in the lower reaches;
- There was reduced access through the woods and to the Loch because of accumulated wood debris and dense vegetation;
- An open water channel to the Loch should be maintained to allow fish migration. This should include bank maintenance to prevent trees falling into the river but there is also a need for fallen trees in the river to provide habitats for insects and cover for fish and otters;
- Works in the river should be limited during the spring and autumn fish runs.

Since 1993 significant work has been undertaken by the Woodland Trust for Scotland to improve the habitats and pathways. The numerous river channels contain tree debris and substantial volumes of coarse sediment. The tree debris can become securely lodged in the channels creating sheltered habitats but it can also cause additional accumulations of sediment, the diversion of river flows and a restriction for the migration of fish. The sediment accumulations form partial blockages in the channel and series of large slow flowing pools with downstream riffles. Removal of some tree debris takes place while excavation of the sediment has occurred particularly in the Coiltie where material has been bulldozed laterally to form a canalised channel. The accumulations of tree debris and sediment have created problems by partially blocking the channel to migrating fish and also reducing the capacity of the channel causing flood flows to spill out of bank. Management agreements still have to be resolved for these issues which take into account the short term problems and also the continuing high sediment loads from the upper catchment over the next few decades.

c Balnagrantach SSSI / SPA

Balnagrantach is a designated SSSI and also part of the North Inverness Lochs SPA for its population of nationally rare Club Sedge (*Carex buxbaumii*) and its breeding population of Slavonian grebe (*Podiceps auritus*). It is located 3 km north-west of Drumnadrochit and comprises three upland lochans (Loch na Ba Ruaidhe, Loch nam Faoileag and Loch nam Bat). Two of the lochans (Loch nam Faoileag and Loch nam Bat) provide a public water supply for Glen Urquhart. The catchment area for the lochs is mainly moorland with coniferous plantations and small areas of natural woodland regeneration. No water sports take place on the lochs but the sites are popular for passing tourists and birdwatchers.

Management of the SSSI concentrates on the Slavonian grebe population. Threats to the birds include:

- Changes to the loch water level
- Changes in the quality of water
- Siltation of the lochs

- Increased pressure from visitors and recreational users
- Increases in predation

These threats are considered to arise from:

- Changes to the loch water level related to abstractions for the public water supply
- Grazing pressures
- Afforestation
- Visitor pressure
- Climate change

d Corrimony Nature Reserve

The RSPB Corrimony nature reserve covers an area of 1531 ha of which some 1230 ha lies within the upper Enrick catchment. An NVC vegetation survey was carried out in 1998 to collect vegetation and botanical data. The site was described as being a mixture of upland habitats including heather moorland, mire, remnant semi-natural woodland and conifer plantation. The vegetation and plant species on the site have links to both western oceanic types and more eastern continental types. This has given rise to a relatively unusual assemblage of communities.

Within the site there is 77 ha of mature plantation conifer woodland and 267 ha of immature plantation conifer woodland. The mature plantation has a dense canopy while the immature plantation is 10-15 years old and is around the stage of canopy closure. Pre-planting ploughing was carried out on the immature plantation.

The overall aim is to recreate a mixed woodland of Scots pine, birch, willow and rowan within a mosaic of open heath and mire habitats using a mixture of natural regeneration and planting. This will benefit a range of flora and fauna associated with Caledonian Forest habitats, particularly black grouse and in the longer term capercaillie. Management will also aim to improve the amount and condition of blaeberry in the plantations by a combination of reducing grazing pressure, thinning and small glade creation. As woodlands develop on open ground blaeberry should respond where it is present as it is a more shade tolerant species than heather. Black grouse are known to benefit from longer vegetation for nesting sites and because long vegetation supports more invertebrates.

Natural generation of native woodlands will be encouraged on the reserve and the sites where this is likely to be most favourable are close to stands of existing woodland. In general the favoured areas are between the River Enrick and the Allt Coire Mhoir and along the north west flank of Carn Bingally-Carn na Beinne Bige. In addition river gorges are a rich source of woodlands in particular the gorge near Corrimony Falls.

91 species of birds have been recorded on the reserve, 59 of which are proved or assumed to be breeding species. Within this there are 10 species which are red list species (species of greatest concern because of population decline) and which breed in the reserve. Mammals include red squirrel, mountain hare, pine marten and otter. Deer management is important for many aspects of the hills. Primarily red and roe deer. Culling is carried out in the reserve to reduce the density to less than 5 red deer per 100 ha with future numbers dependent on the success of tree regeneration and

ground flora. The erection of a high “grouse friendly” fence and an electric fence has reduced numbers. A deer management group has been formed with neighbouring owners.

3.4 Summary of issues within current management plans

A number of issues were identified in the management plans for the designated areas. These are listed below:

- There is a need for “appropriate” planning in the catchment;
- Development should be encouraged of diverse, multi-purpose forests through sustainable forest management – forests should blend into the landscape – forests should not impact private water supplies, aquatic habitats and natural water courses;
- Support should be given to the expansion of native woodlands using existing areas as nuclei for development - some planting should be carried out in suitable areas remote from seed sources - deer numbers should be reduced to less than 5 per 100 ha and sheep numbers to less than 1 sheep per 4 ha;
- Remove deer fences and replace with either “grouse friendly” methods or culling;
- Management of the river for fisheries should include the channel where sediment deposits, boulders, pools and riffles should be featured - the channel should not be canalised - protection of the river banks should use appropriate technologies such as croys - riparian areas should include semi-natural vegetation along river banks, fencing to protect river banks and the maintenance of access routes to the river;
- Urquhart Bay Woods requires periodic flooding to maintain its conservation interest;
- Artificial management of water levels in Loch Meiklie should be avoided as there are numerous developments around the loch which would be disrupted
- Loch Meiklie should not be used for fish farming or watersports
- The community should be involved in developing management plans;
- Recreational facilities should be maintained;
- Archaeological sites should be safeguarded;
- Water abstractions should not be inappropriate;
- Grazing pressures on the hills should be avoided;
- Visitor pressure on the hills, in the glen and the settlements should be controlled to avoid damage;
- The effects of climatic change should be taken into account.

Q2 ► Views are sought on whether this summarises the main issues in designated areas and whether they are appropriate for management throughout the catchment.

4 Community issues

4.1 Public meeting

A public meeting was held in Drumnadrochit in March 2001 where the issues of concern in the community were discussed. The meeting concentrated on flooding as this had been the main issue which had instigated the ICMP. The major part of the meeting revolved around 8 key questions, the following summarises the responses to each one:

How has flooding in the catchment changed?

- Upstream of Loch Meiklie the two rivers have different responses depending on the weather types but it is not known whether their response has changed over time.
- Downstream of the loch it was thought that floods are now more frequent and during flood events the rivers rise more quickly than they used to do.
- Loch Meiklie has been reduced in volume in the past 20-30 years by sediments deposited by the inflowing river, this could have changed the storage of water during flood events.
- Immediately downstream of the loch to the Mill of Tore the ground is flat and operates as a storage area for flood waters. The trees on this ground also act as a baffle to slow the water down and there is little damage to the ground.
- A lade constructed at the Milton of Buntait some 200 years ago was thought to have resulted in additional flooding over the fields in that area.
- Flood banks upstream and through Drumnadrochit have been altered in recent times which has affected the floods. Some riparian areas upstream of Drumnadrochit have been protected with flood banks confining the river and resulting in the loss of flood storage areas. This increases the rate of flow and can cause erosion on the opposite banks where the water is deflected away by the flood banks.

What management was carried out in the river 50-100 years ago?

- Upstream of the loch the flood banks were rebuilt in 1948.
- In the past the outlet of the loch was cleared every two years to reduce the level of the loch. This is likely to have increased the potential storage of flood waters.
- Mill lades were constructed in the catchment and during the early part of a flood they will removed water to additional storage areas rather than filling the areas close to the river.
- The glen road was re-built around 1960-1970 and could have had an impact on flood waters.
- River protection measures used to be log and stone walls built to protect the banks.
- Trees in the river are not un-natural and can help to slow the water and sediments down although they can be inconvenient.
- In the past Loch Ness was raised by some 6 feet this undoubtedly affected drainage of the delta area where old flood banks are now partially buried with new sediments.

How has the recent problem with the river affected the community and the local businesses?

- The flooding has impacted many properties and land.
- Recent high rainfall appears to have raised ground water levels reducing the ability for soak away from septic tanks at 15 houses and increasing the amount of surface runoff. This has potential implications for the quality of water entering the river.
- One large flood removed an old bridge which was replaced with a better (but temporary) one, there is now improved access for vehicles, including timber lorries.
- The effects of the flooding on tourism were thought to be quite small. There would be a larger impact if the floods occurred in the summer months.

How has the flooding affected the fisheries?

- The Enrick is an important nursery river for the fish populations in Loch Ness. Disruption to the habitats is likely to affect fisheries in the wider area.
- The Enrick was the last beaver habitat in Britain

Should further built development be allowed close to the river?

- There was general agreement that new developments in the delta area could have a problem in the future.
- Loch Ness can back up into the area creating a problem for flood waters from both the Coiltie and Enrick rivers.

Is a flood warning system needed and how many hours warning do people need?

- An improved flood warning system is needed, the current one has limitations because warnings are distributed by a cascade system where three people are initially warned and they alert others.
- The system fails if these people do not receive the communication or if they go out to work on flood protection measures.
- The system of alerting people needs alternative routes in case one breaks down.
- In addition the current warning only operates on a one level warning and it is not known whether this is the most useful level to trigger a warning. An upgraded system is probably needed with two or maybe three levels of warning.
- The current system only operates below the Loch, the people above the Loch also need warnings.
- The required warning time is about four hours to move animals off land at risk of flooding.
- The protection of housing and other issues of concern, such as the transport of children from schools, this is more difficult to assess but generally 2-4 hours

How should the community be involved in the operation of an integrated catchment management plan?

- The existing Glen Urquhart Land Use Partnership is the most appropriate body to represent the community.
- Consideration needs to be given to the long term management of the plan and any maintenance schemes which are proposed and implemented.
- A community self help scheme should be operated rather than relying on the authorities although this should not depend on individuals funding the scheme.

Can a good catchment management plan provide related benefits to the community e.g. publicity increasing tourism?

- It is possible that the plan could contribute to “green” tourism and it may help other communities with similar problems.

4.2 Individual consultations

A number of individual meetings were held to discuss certain issues in more detail. These discussions tended to concentrate on river related issues but other points were also mentioned.

In the upper Glen, above Loch Meiklie, the future of hill farming is a major concern as well as flooding, forestry and access. Most land management is only carried out when grant aid is available. Support from the Scottish Executive and European Union are essential in sustaining traditional land management and upland communities. The uncertainty of long term financial support makes planning beyond 5 years very difficult and there is little incentive to try alternative forms of income.

Siltation of the river channel above Loch Meiklie is causing a problem at Corrimony ford, which has to be regularly cleared, and further downstream where sediment accumulations have raised the channel bed increasing the likelihood of flood waters over-topping the banks. Inundation of the flat land between Corrimony and Loch Meiklie is an accepted event and the silt and debris left behind by the flood waters are not a major problem. Some damage has been done to the flood banks when high flows have overtopped them but with regular maintenance and repair this again is not a major issue.

Damage has been done to the high bluff on the right bank of the river at the Milton of Buntait. Erosion of this banking has created a major scar which is highly unstable generating large volumes of sediment which are deposited in the river. This is now partly blocking the channel and causing erosion of the field on the left bank. Below this the river caused a serious problem some years ago when it eroded the left bank including part of the public road. Protection of this bank is now with large rocks however the river is still directed straight onto this bank.

Immediately upstream of the loch the fields have been drained in the past and the river channels altered. However the vegetation is now reverting back to more wetland types indicating a recent rise in the water table in this area. It is thought that sediment deposits at the exit from the loch have been building up in recent years raising the water level and restricting drainage of the surrounding fields.

In the middle section of the catchment from Loch Meiklie to Drumnadrochit Bridge the major issue within the community is the erosion of the river banks and the siltation of the river channel. At several places, for example at Polmaily, there has been serious erosion caused by the recent floods. River banks are eroding rapidly with the loss of valuable arable land. In other places high banks are being undercut with regular collapse of the bank into the river. The channel can be filled with material which raises the water level causing more frequent overtopping of the banks or the redirection of the flow of water and further erosion. Linked to the river bank erosion is the collapse of trees from the banks into the river with these trees potentially causing further bank erosion and blocking bridges.

In the lower Glen the main environmental concern is also related to the river with many people now living in fear of heavy rain. Flooding of gardens, houses and the main road at Kilmichael has occurred several times with damage done to houses, gardens and other property. In Drumnadrochit from the bridge to the car park flooding has occurred in the past decade. Water has over-topped the river bank and flowed over the field behind the Post Office and Police Station, though the houses, over the main road and into houses below the road. Damage to properties has been extensive and there is now concern that another flood will jeopardise insurance cover for the houses. The problem is largely blamed on sediment and debris accumulations in the river channel reducing the capacity of the channel to contain floods. This is likely to become worse if the large amounts of sediment further up the river continue to move downstream.

4.3 Summary of issues within the Community

The following lists the main issues within the Community:

- The rivers upstream of Loch Meiklie have different responses – this has major implications for an upgraded flood warning system;
- Siltation within Loch Meiklie has affected the amount of water storage and in the past the outlet from Loch Meiklie was lowered every 2 years – Loch Meiklie is likely to be a major control on flood water levels both upstream and downstream;
- Floodbanks have been modified recently and have reduced the areas for floodplain storage affecting the downstream flooding;
- Mill lades potentially help to reduce flood levels – the effect may be small compared with modifications to Loch Meiklie and to floodbanks;
- Loch Ness was raised by some 6 feet increasing the flooding of the delta area – this is undoubtedly correct but it is unlikely to be reversed in the future;
- The operation of septic tanks has been affected by higher ground water levels;
- Major disturbances to the river are affecting the fisheries in the wider area;
- Further developments in the delta could be at risk from flooding;
- A flood warning system is needed above and below the Loch with warnings of 2-4 hours;
- The ICMP should be implemented through the Glen Urquhart Land Use Partnership with strong community involvement.

Q3 ► Views are sought on whether this summarises the main issues of concern to the community

5 Features of the catchment: issues and potential effects

5.1 Physical

Issues

The River Enrick catchment has an area of 145 km² forming some 10% of the River Ness catchment area (Fig.5.1). It has a maximum altitude of 679 m AOD and an outfall into Loch Ness at approximately 15 m AOD. The proportion of the catchment area at different altitudes reflects a large bias to higher altitudes with some 51% of the area being above 300 m but only 14% below 200m. Hillslopes throughout the catchment are moderate in gradient apart from in Glen Urquhart where the river passes through a relatively steep sided and narrow valley.

The long profile of the river (Fig.5.2) shows two significant breaks in the channel gradient at Corrimony Falls and Loch Meiklie. In the upper section above Corrimony Falls the channel gradient is steep with the river flowing over bedrock and down deep gorges. The rock outcrop of Corrimony Falls forms a local control for hillslope and river channel development. Significant erosion of channel bluffs has occurred immediately upstream of the falls with huge amounts of sediment deposited in the channel. This has blocked the river, diverting its course destroying most of the aquatic habitats. It is also understood that some time ago gravel was extracted from this section of the river by the Forestry Commission to construct the hill road through the upper catchment. Piles of river sediment still exist next to the channel contributing to the sediment load of the river.

Below Corrimony Falls the channel gradient becomes very gentle with the river meandering over the flood plain before reaching Loch Meiklie. An extensive delta has developed below Corrimony Farm with coarse sediments deposited near the river channel and finer sands and clays further away. The approach to Loch Meiklie is a small wetland area through which the river meanders. The local control at Loch Meiklie is a narrowing of the valley bottom and a broad ridge of sediments deposited across the constricted valley bottom. This is likely to be a relic feature of glacial times with more recent sediment deposits originating from the tributary burns.

Below Loch Meiklie the gradient of the channel is moderate with the river confined within the relatively narrow gorge of Glen Urquhart. Deep sediment deposits form the bottom of the Glen, relics of ancient debris flows probably in the immediate post glacial era. The river is highly energetic through this section due to the gradient of the channel with substantial power to erode the sediment deposits.

Potential effects

The large proportion of the catchment area at relatively high altitude is not unusual for a highland catchment where extensive plateau areas have been dissected by glacial erosion. The distribution however makes these catchments vulnerable to intense rainstorms combining with snow melt. Although the catchment is in a rainfall shadow of the west coast mountains there are still frequent and intense storms generated by local conditions. Substantial volumes of snow can also be stored in an altitude range (300 – 600 m) where snow packs accumulate until warm air causes a sudden melt. This is in contrast to the low altitudes where snow will melt gradually over the days following the fall and the very high altitudes where the snow will last for substantial periods through the winter.

Fig.5.1 The River Enrick catchment

The natural breaks of river channel gradient at Corrimony Falls and Loch Meiklie are significant in both slowing down the flow of water and trapping river sediments. These features are likely to be particularly important in affording some protection to the steeper channel downstream through Glen Urquhart. The recent erosion in the river channel has contributed huge amounts of mixed sediment to the river which has caused substantial changes to the channel and the destruction of the aquatic and riparian habitats. The sediment is likely to be moved mainly in the largest floods and this is likely to continue for several decades until the river re-establishes a stable channel. This recent devastation to the river is not a unique event as there are many example of relict erosion scars which have now become stable through vegetation re-establishment. This narrow floodplain is therefore subjected to regular erosion and occasionally large and devastating events and any structures such as bridges are vulnerable to damage during these events.

Q4 ► Views are sought on the physical issues described and their potential effects

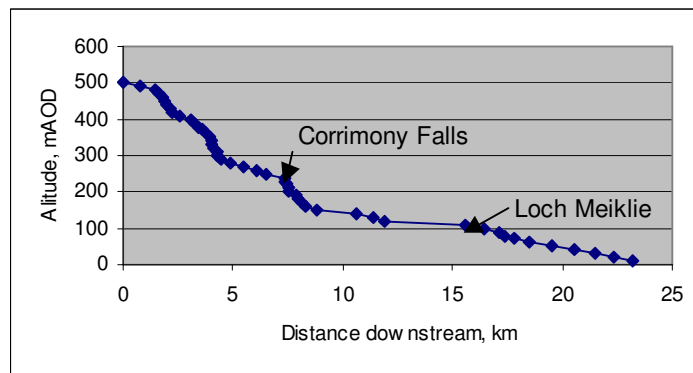


Fig.5.2 Long profile of the River Enrick channel

5.2 Drainage

Issues

The structural geology of the region produces a topography of ridges and valleys orientated in a SW to NE direction parallel to Loch Ness. Drainage lines in the Enrick naturally follow this direction in the upper altitudes with rivers cutting through the ridge lines to reach the lower altitudes (Fig.5.3). The natural drainage density of the catchment expressed as the length of drainage lines on the 1:50000 OS map divided by the catchment area, is 0.83 km km⁻². There are also substantial areas of standing water over the upper catchment including some 98 high altitude lochans and the larger Loch Meiklie. Some modifications have been made to the natural drainage patterns in the catchment. These include old moorland gripping, hillslope drainage for forest plantations and roadside drains directing flows into culverts.

Fig.5.3 Drainage patterns in the catchment

Flows in the tributaries were measured during August 2001 to identify those tributaries which contribute the highest proportions of flows. The results show that four tributaries contributed 77% of the flow in the Enrick below Loch Meiklie. The proportion of the flow in each tributary was:

Allt Seanabhaile	23%
Allt Feith Riabhachain	21%
Allt Drimneach	18%
River Enrick above Corrimony	15%

The majority of the flow into the main river is therefore from tributaries upstream of Loch Meiklie.

Loch Meiklie is a major surface water feature in the catchment, storing large quantities of water and attenuating flood waters. Flow into the loch is from the west with a single outlet to the east. At the input of the loch the flat valley bottom has resulted in silt being deposited over centuries of time causing partial infilling of the western end of the loch and forming a wetland area. Some straightening of the river channel in this area was noted in a previous report (Halcrow, 1990) and both tributaries entering from the south have also been diverted in the past. The outlet from the loch is naturally confined by slightly higher ground on either side and subsequently by the construction of the road bridge. The channel below the bridge drops in elevation relatively quickly compared to the channel upstream of the loch. It was noted earlier that the output channel from the loch was manually lowered every two years but this is no longer carried out. Apparently this was to lower the water level and improve drainage of the marsh area at the western end.

For the natural environment Loch Meiklie is an important feature being a dominant visual feature, a place for shoreline recreation and a popular fishing site. Facilities have been developed around the Loch and it would be disruptive if the level of the Loch was artificially changed to accommodate flood waters. While fish farming and water sports have been mentioned in the past these are unlikely to be acceptable developments in the future.

Potential effects

The old moorland gripping and the forest drains were both carried out some time ago and now most channels are silted up and there is little evidence of any substantial flows down these ditches. Culverts under roads have given more problems during storm events. Blockage of culverts can cause a diversion of flows into other drainage channels and a concentration of flood waters.

The flow in four main tributaries was shown to contribute the majority of the summer flow in the main river. These tributaries all flow into the area upstream of Loch Meiklie with the loch water backing up into the floodplain forming the wetland. It is understood that in very dry summers a large proportion of the flows percolate into the floodplain sediments with several watercourses drying out. Sub-surface flows are likely to percolate into Loch Meiklie sustaining the level of the loch during these dry summers. This sub-surface flow is also a possible explanation for the very low summer surface flows recorded by SEPA at the Mill of Tore gauging station. The reported artificial lowering of the loch outlet in the past was probably to reduce the water level in the wetland so that the fields could be used for hay. Recently this lowering has not been done resulting in the increased wetness of the fields.

During flood flows the tributary inputs are likely to have different responses depending on where the rainfall and snow melt were concentrated. The inputs from these different tributaries are likely to produce a series of pulses in the main river as each tributary catchment responds in a slightly different way. With most of the tributary flows entering the system upstream of the loch these pulses will be smoothed out by the large water body and the outflow will be a more uniform flood wave. Storage within the loch will also alter the magnitude of the flood peak. In small and medium floods the magnitude is likely to be reduced as water is stored during the storm and slowly released after it. In high floods the storage is likely to be exceeded so that additional flood water is transmitted rapidly through the system and down Glen Urquhart. If the storage capacity has not been reached by the time the input peaks then the loch will lower the downstream flood peak but if the capacity has been reached before the flood enters the loch then the downstream flood will not be significantly attenuated. The lowering of the outlet from the loch could affect this by lowering the water level before a flood and increasing the capacity to store water and attenuate flood peaks.

Q5 ► Views are sought on the drainage issues described and their potential effects

5.3 Farming

Issues

Farming in the Enrick catchment is primarily grazing for sheep and cattle with some of the ground in the valley bottom used for summer hay or silage. Recent agricultural problems such as foot and mouth disease and BSE have created large difficulties for the hill-farming throughout Scotland. Most farms now rely heavily on grants while some also look to alternative forms of income either through diversification by turning to tourism or a complete change of land use to forestry. The long term planning for farmers is now extremely difficult given the problems of disease, market prices and uncertainty in grant aid. Little money or time is now available for working on environmental issues and much of the land management experience of past generations is slowly being lost.

The lack of new ideas for the long term support of hill farming is an issue when compared to the problems being encountered and the support offered for urban areas. Suggestions that the solution is diversification or changes in land use may be good theoretical ideas but they have little real value in guaranteeing sustainable farming communities. The lack of long term commitments to the support of hill farming communities is likely to impact the countryside in the long term. This is the major natural asset of an area such as the Enrick and recognition of the good stewardship of the countryside by farmers needs to be followed up with support.

Potential effects

The effects of uncertainty into the future of upland farming is having a widespread impact throughout the Highlands. There are currently no quick and easy solutions which will sustain traditional farming practices and communities. Longer term options

are equally difficult to produce. The potential effects are for widespread changes throughout upland catchments such as the Enrick. Without farmers' experience of managing the countryside there will be a rapid decline in the upland environment and a widening gap between the more advantaged lowland communities and the uplands. For the Enrick catchment there can be great benefits in working together.

Q6 ► Views are sought on the farming issues described and their potential effects

5.4 Land use

Issues

Land use in the catchment is mostly open moorland at higher altitudes with mixed woodlands and arable or pastoral land below 350-400 m (Fig.5.4). The areas (and proportions of the total catchment area) of the major land uses are:

Open hill – (moorland)	6692 ha (46%)
Woodland (managed by FE)	2742 ha (19%)
Other woodland	2749 ha (19%)
Arable / pastoral	2317 ha (16%)

The upper catchment is predominantly moorland with heathers dominating the drier ridge tops and coarse grasses the wetter areas. Within the deep gullies some remnant shrubs and trees have survived the intensive grazing pressures from sheep and deer. The trees now form strips of woodland down the gullies and along the main watercourses. Some small areas of plantation forest exist in the upper catchment forming isolated blocks of dense forest. Some areas were drained prior to planting and one block, around Druim na h Aibhne, suffered fire damage in 1997 when some 170 ha of trees were destroyed.

Native woodland expansion is being encouraged in the higher parts of the catchment with support from the Woodland Grant Scheme. Extensive deer fences have been erected over the upper catchment to exclude deer and sheep from areas which have recently been planted with native tree species.

In the lower catchment there are large areas of native woodlands with a particular concentration on the north side of the Glen. The woodlands are broken up by areas of cleared ground where enclosed fields have been created for arable and pastoral land uses. These individual areas are generally small although the total area as a proportion of the whole catchment is significant (16%). Many patches of native woodland have been integrated with the plantation trees forming extensive mixed woodlands of different species, ages, habitats and at some times of the year contrasting colours. The existence of significant areas of native woodland provides the potential for expanding and merging these types of woodlands.

Fig.5.4 Land use in the catchment

The area of plantation woodlands in the catchment appears to be large however this is mostly due to these woodlands being in highly visible locations, particularly on the south side of Glen Urquhart. Ownership and management responsibilities in the whole catchment includes the Forestry Commission, Forest Enterprise, RSPB, Tillhill Forestry and Scottish Woodlands. Most of the plantation woodlands were planted before modern forest management practices had been developed. Mistakes of the past are therefore still in existence and current management has to cope with these problems.

Problems associated with the older areas of plantation forests include the additional drainage of hillslopes before planting, high density of trees, planting up to the edges of watercourses, single aged forests and straight forest edges. Current forest management now recognises that the potential impacts of these old styles of forests include increased runoff rates, increased evaporation, loss of aquatic habitats, impacts associated with clearfelling and the detrimental visual effects. Current practices have been developed to guard against these effects although it is unavoidable that there will still be old style forests in existence for many more years.

Clearfelling of the largest area of plantation forest on the south side of the Glen started in the late 1970s mainly using skylines for timber extraction. Replanting took place almost immediately and included some ground preparation. In February 1989 the area was devastated by a major storm when a substantial part of the forest was destroyed by wind-blow. Most of the wind-blow was cleared away however fallen trees in deep gullies had to be left. There is now substantial regeneration over the whole area, including along watercourses, creating a single aged forest with almost blanket cover. This is not desirable under modern forest management and Forest Enterprise plan to thin the trees once they become economically viable within next 5-10 years. This will open up the forest creating multi-aged forest, open areas around existing native trees and clearing riparian zones along all burns. The new forest structure will benefit the natural environment, habitats, the visual impact and access possibilities.

Excessive amounts of tree debris still exist along many water courses. Tree debris has the potential benefit of trapping sediments during floods and act as a slow release as the debris rots. Excessive amounts however create constrictions in the channel, cause more erosion and preventing animal migration. Where this occurs there should be a slow removal of the excess debris, approximately 10% of the debris per year gradually returning the channel to a natural state.

Several hill roads exist throughout the catchment, particularly in the areas of plantation forests. They are generally in a good state of repair although some culverts cause problems and require frequent maintenance. A new hill road has recently been extended onto the open hill above Shewglie. This provides vehicle access into the higher parts of the catchment but the use of culverts in this environment has to be questioned and a slit trench, which has been dug to drain an access point in the forest fence has eroded very badly. These are example of poor management on a potentially erodible hillslope.

The forests are a significant feature of Glen Urquhart and there is a large potential for developing them as an ecological, recreational and tourist facility. Changing the forest structures and removing un-necessary fences will help but there is also a substantial amount of new development needed. In the lower Glen there are many view points of the surrounding hills and Loch Meiklie which have been lost by

uncontrolled tree growth. The forest roads also provide excellent facilities for recreation and for access onto the higher ground where views of the catchment are stunning. There is a large potential for developing forest walks which could include scenic view points, waterfalls and glades in the woodlands.

Potential effects

The majority of the land use issues in the catchment are related to woodlands. It is considered that the patches of plantation forest in the upper catchment have a negligible effect on rainfall - runoff rates as the areas are small compared to the rest of the upper catchment and drainage ditches stop short of the natural water courses. The new native woodlands have been planted using a mounding technique which also has a minimal effect on runoff rates. There is however a concern that snow storage and snow melt might be changed by expansion of the existing woodlands and the deeper vegetation within fenced areas. In particular the open nature of the forests with wide buffer areas are ideal for snow accumulations with the trees protecting the snow from melting. Snow will therefore be stored on the hills for longer periods until large storm events occur which cause rapid melt adding to the runoff caused by the rainfall. In recent years some blame has been apportioned to the forest operations for the high floods. It is however most likely that the floods were caused by very heavy rain and snowmelt on the hills above the forests with little modification either increasing or decreasing by the forest. The lack of extensive forest drains on the hillslope discount a possible forest problem and it has been shown in the past that trees do not affect flows in very high rainfall events.

Other factors which could have affected runoff rates from the upper catchment are the construction of the hill-road, the small areas of old moorland gripping and the artificial raising of Loch Comhnard. None of these changes are likely to have significantly affected flows in the main river.

The deer fences successfully control the movement of grazing animals however they restrict access for hill-walkers, restrict the movement of other animals and create a barrier between similar areas of forest regeneration. A long term management agreement is needed to ensure that these fences are effective in protecting the juvenile trees but do not cause problems in other parts of the upper catchment environment and allow different types of woodland habitats to merge and species to move between different areas.

Q7 ► Views are sought on the land use issues described and their potential effects

5.5 Fisheries

Issues

The River Enrick is one of the main salmon spawning and juvenile nurseries in the Ness catchment and therefore good management of the river is very important for the fisheries interests. In 1997 the Fisheries Management and Protection Programme was initiated to carry out an itemised programme of work in the area.

A fry and par survey was carried out in the River Enrick during 1997 with a total of 10 main river sites being sampled. The river was said to be “a significant salmon spawning and juvenile nursery river and this status should be maintained”. Results showed that the densities of 0+ salmon fry and >1+ salmon par at all sites were acceptable with most salmon smolts leaving the river being 2 years old with some aged 3 years old. The survey also included the physical characteristics of the sites showing that the composition of the substrate was mainly cobble sized material at 6 of the 10 sites but 4 of the sites had more than 50% of the material composed of rocks or boulders > 25 cm in diameter.

Physical changes in the river channel caused by the recent floods have had an adverse impact on the fisheries interests of the river and the aquatic habitats in general. Severe erosion of the river bank has resulted in large amounts of coarse sediment to be dumped into the river. This has caused blockages in the channel, diversion of the river flows and the undermining of river banks and bluffs. Fine sediment is also produced by the erosion creating highly turbid waters during flood events. Both types of sediment are detrimental to the fisheries interests with the former disrupting fish migration and spawning and the latter damaging fish gills and filling redds with silt.

Fishing in the river and on Loch Meiklie is now very limited although many people would like to see it increased. Many of the traditional fishing pools have disappeared due to the large accumulations of sediment in the channel and overgrown conditions on the river banks are restrictive to rod fishing.

Potential effects

River habitats have been greatly affected by the recent influx of large amounts of coarse sediment which has implications for fisheries throughout the lower Ness catchment. The large size of the material composing the substrate is not suitable for salmon spawning while the mobility of the material in the channel produces instability of the redds and the potential loss of eggs during flood events. Finer sediments are also affecting the fish and their spawning grounds. Bank side vegetation is largely uncontrolled creating difficult conditions for rod fishing and also un-managed shading of the river and the potential for trees to fall into the channel creating obstructions and hazards if mobilised during flood events.

The recent impact on the river are therefore causing serious problems to the fisheries on the river. Improved management of the river for the fisheries will result in much wider improvements to the river environment. Fisheries will therefore form an important component of the future action plan for the river.

Q8 ► Views are sought on the fisheries issues described and their potential effects

5.6 Habitats

Issues

Many of the issues affecting habitats have been described in previous sections; this is a brief summary of the main points. Contrasting habitats exist in the catchment linked to the diversity of environments and exposures. Habitats include heaths and moorland at high altitude, aquatic habitats (lochs and rivers) and a range of woodlands at lower altitudes from plantation conifer forests to wet woodlands in the delta below Drumnadrochit.

The open hill habitats have been described before as upland moorland and comprise a mixture of dry and wet heathland. The condition of the vegetation is greatly affected by the high levels of grazing by deer and sheep which have been high enough to retard any tree growth except in deep gullies, inaccessible to the animals. In the higher parts of the catchment there are many small and medium sized lochans often only fed by rainfall, small springs or ground seepage. In other parts there are large areas of bog and mire mostly well preserved with little erosion.

The woodlands have also been described previously and shown to be a variable mixture of native woodlands, plantation forests and strips of woodland along the rivers and burns. Expansion of the native woodlands and the transfer to the second cycle in the plantation forests are the main issues related to these habitats. The expansion of the birch woodlands is mainly to higher altitudes and is being achieved both by manual planting and natural regeneration. In addition scrub willow is seen more extensively but pine is more limited due to the smaller number of sources. Natural regeneration is greatly controlled by the existence of deer fences which prevent grazing but restrict the transport of seeds away from parent sources by animals.

The best riparian woodland habitats in the catchment are in the delta below Drumnadrochit. The woodland is a core of ancient woodland that has survived agricultural reclamation because of the poor soils and the regular inundation by flood waters. Floodplain woods require periodic flooding to maintain the conservation interest, in the Urquhart Bay Woods the flood waters can extend over the whole woodland area and also over some of the agricultural areas. Some excavation of the channels occurs to try and reduce the areas of inundation and to ensure the migration of salmon. The site has been invaded by non-native plant species including Japanese knotweed, lupin, white butterbur, snowberry and sycamore.

Potential effects

Habitats throughout the catchment are changing in response to the various land use changes which are being implemented. The high altitude habitats are likely to be vulnerable to some climatic change scenarios although communities and species may be capable of adapting to these changes. Increased pressure from recreation can adversely affect these environments which are considered to be fragile when subjected to physical impacts such as the regular trampling by hillwalkers.

The expansion of the native woodlands to higher altitudes is re-creating shelter in these exposed locations which should be beneficial however the use of fences to establish these habitats can be detrimental by creating barriers between the different types of woodland and the open hill above. The lower woodlands in the delta area

have been subjected to change, mostly related to the clearance of sediments and tree debris from the river channels and the construction of flood banks to prevent flooding of the neighbouring agricultural land.

Q9 ► Views are sought on the habitat issues described and their potential effects

5.6 Infrastructure

Issues

The infrastructure in the catchment is concentrated in Drumnadrochit and the links between the small settlements (Fig.5.5). Drumnadrochit is at the junction of the Inverness to Fort William road (A82) and the road west to Glen Affric (A831). The A82 is an important route both for commercial and tourist traffic while the A831 is used mainly by locals and tourists. The relatively high standard of the A82 encourages tourists to visit the area while people from the nearby large centres of population can gain easy access for recreation. The A831 is a spine road extending through Glen Urquhart and over to the popular Glen Affric. It is a high standard road although for tourist related businesses and enjoyment of the environment it encourages rapid transport rather than slowing people down.

The series of bridges over the Enrick were damaged and washed away during the recent floods being replaced by “temporary” metal bridges. These bridges are all for roads leading to individual houses or small communities and appear to have become permanent structures. The bridge at Drumnadrochit survived the floods although there is some local concern about the volume and weight of traffic now using the bridge.

The disposal of sewage and waste water has been a major issue over the past years. Upgrading of the sewage treatment plant, including the re-alignment of some pipes, at Drumnadrochit has improved the situation for the largest settlement and also the quality of water being discharged into Loch Ness. Many smaller communities are however still using septic tanks. Problem have occurred in recent years with overspill water unable to seep into the ground because of the high water table. This has created a major issue during flood events when raw sewage has been deposited over gardens and during non-flood events when the waste water flows more easily into the river system.

Potential effects

The aspects of the infrastructure of most concern are the road network, including the small bridges and the disposal of sewage from the smaller communities. The road through the Glen is a high standard but it is preventing visitors enjoying the scenic qualities of the area and potentially stopping to use recreational and tourist facilities. This is hindering the support and development of recreation and small businesses in the major part of the catchment area.

Fig.5.5 Infrastructure in the catchment

The current method of disposal of sewage from the small communities is creating a health hazard to many households and a water quality issue for the river.

Q10 ► Views are sought on the infrastructure issues described and their potential effects

5.7 Flood protection measures

Issues

A number of flood protection measures have been implemented in the catchment over past decades. Flood banks are extensive along the main river from the fields near Corriemony to the delta below Drumnadrochit preventing frequent inundation of the valuable farm land, houses and other buildings. River bank armouring has been carried out in some places, notably below the Milton of Buntait, controlling the lateral movement of the river across the floodplain and preventing erosion of agricultural land or roads and breaching of the flood banks. Most construction work has been undertaken along the natural course of the river with little channel re-alignment. Some straightening of the channel upstream of Loch Meiklie and in the delta below Drumnadrochit was noted in a previous report (Halcrow, 1993). Re-alignment as also occurred immediately above Drumnadrochit bridge where two channels have been blocked channelling all the flow around the left side of the wooded island.

The River Enrick has a large sediment load which in a natural situation would be spread out over the floodplain during flood events. This has built up two large delta features one below Corriemony and one below Drumnadrochit. Because of the accumulating nature of these features they form dome shaped fans over which the river flows. Without floodbanks the river would regularly switch course over the delta distributing the sediment over the whole area.

Potential effects

The floodbanks are effective in preventing most floods overtopping the banks and inundating the riparian ground however the loss of these riparian flood storage cells is to concentrate flood waters in the downstream channels and raise the flood peak. There is no doubt that the floodbanks have produced this effect however the magnitude of the flood peak enhancement is uncertain. The crucial factor is that it is unlikely to be acceptable to remove the existing floodbanks and use the farmland as flood storage cells and therefore the flood peaks have to be managed in other ways.

The protection of river banks has been effective in some places here large boulders have been used to build protective walls. In other locations the protective work has used river sediments which are insufficiently solid to control the river. At several locations the river is eroding the ground behind the protective material while in others the situation has gone much further with the loss of all protective material. The relatively small historical channel modifications upstream of Loch Meiklie are unlikely to have had a significant effect on river flows and were probably carried out to help drain the surrounding land. Immediately above Drumnadrochit bridge the channel re-alignment has probably contributed to the flooding in Kilmichael while below the

bridge the channel modifications have had some effect in controlling the river but resulting in the loss of aquatic and riparian habitats.

Confining the floods to the river channel also confines the river sediments in the channel and where deposition occurs the bed of the river is elevated, in some places above the level of the adjacent flood-plain. In these locations the capacity of the channel to hold floodwaters is reduced which results in more frequent over-topping of the floodbanks. Some small scale removal of sediment from the river channel has been undertaken by farmers for many years with more extensive removal in the delta below Drumnadrochit. While this is effective in most circumstances the excessive amounts of sediment now in the river channel are likely to overwhelm these actions for many years.

Q11 ► Views are sought on the flood protection issues described and their potential effects

6 Climate and hydrology

6.1 Climate

Issues

Monthly rainfall data for the Enrick catchment were obtained for the two Forest Enterprise gauges: Balnain (1966-1996) and Glen Urquhart (1945-1996). The two gauges provide a long record of rainfall in the area which can be used to determine whether changes have occurred and whether the rainfall in the 1990s was unusual compared to previous years. Fig.6.1 shows the 52 years of record from the Glen Urquhart gauge. No overall trend in the data exists but the two highest monthly totals on record occurred in the 1990s. Monthly totals exceeding 300 mm only occurred twice in the first 42 years of record (April 1947 and December 1949) compared to six times in the 11 year period 1986 – 1996.

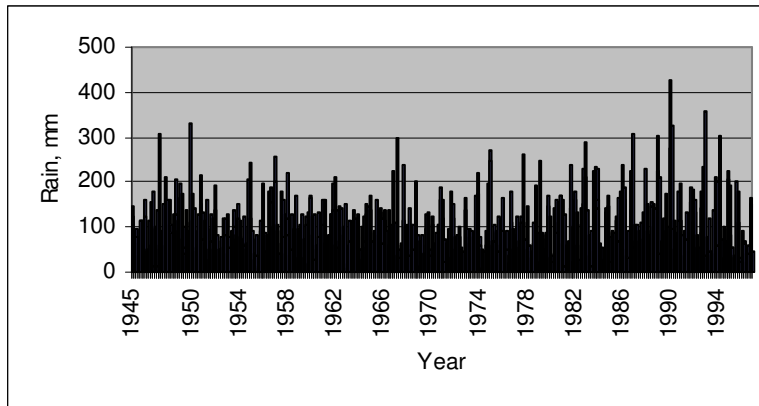


Fig. 6.1 Monthly rainfall from Glen Urquhart (1945 – 1996)

Potential effects

The rainfall record for Glen Urquhart shows no underlying trend in the data however the occurrence of months with very heavy rainfall was more frequent in the later years. Very heavy rainfall can cause damage to an upland catchment but most problems are experienced when heavy rain falls on catchments which have been partly destabilised by previous storms. The catchments need a period without heavy rainfall to recover.

Q12 ► Views are sought on the issues related to climate and their potential effects in the catchment

6.2 River flows

Issues

River flow data from 1980 to 2001 for the River Enrick at Mill of Torr were supplied by SEPA. The data included monthly mean flows (Fig.6.2), annual maximum flows (Fig.6.3) and annual minimum flows (Fig.6.4). To determine whether there is an issue of changing river flows a very long record, in excess of 50 years, would be needed. However the existing 22 year record shows that all of the highest flows in the period occurred between 1990 and 2000. No clear trend exists in any of the data sets suggesting that the floods issue is not increasing but equally it is not decreasing. The annual minimum flows also show no trends although there is a large inter-year variability. Monthly mean flows are reasonably well correlated with rainfall apart from the highest flows where the flows are higher by some 20-50% than might be expected (Fig.6.5). This indicates that for medium flows the main control is rainfall while for the high flows there is a control in addition to rainfall, most likely snowmelt.

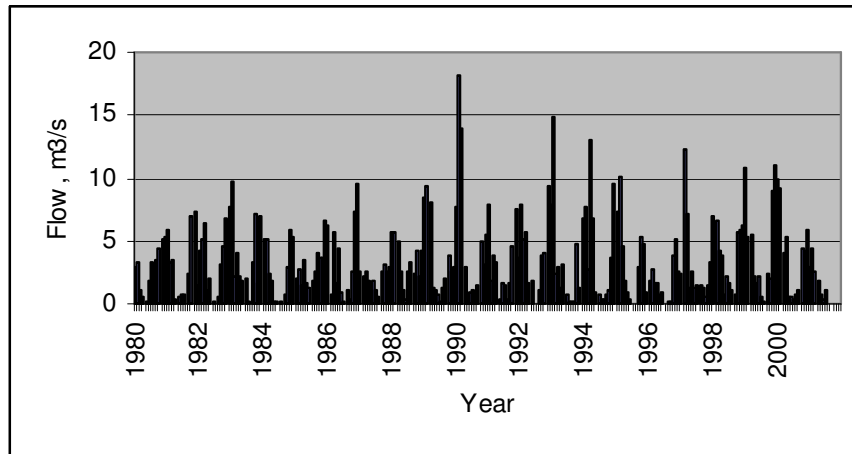


Fig.6.2 Monthly mean flows for the River Enrick (1980-2001)

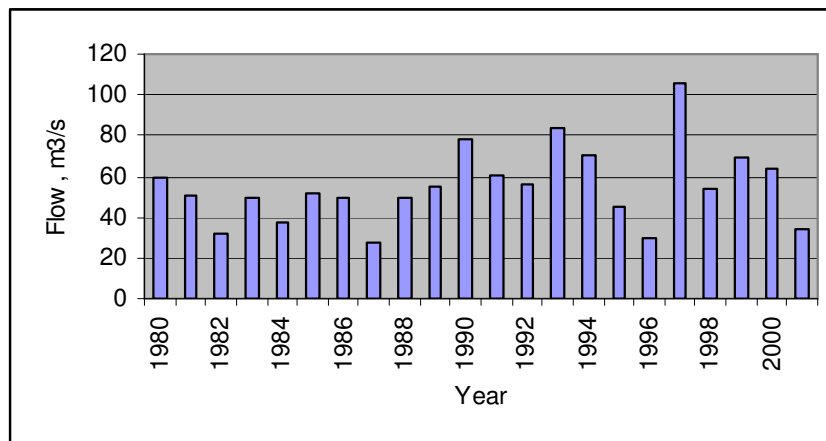


Fig.6.3 Monthly maximum flows for the River Enrick (1980-2001)

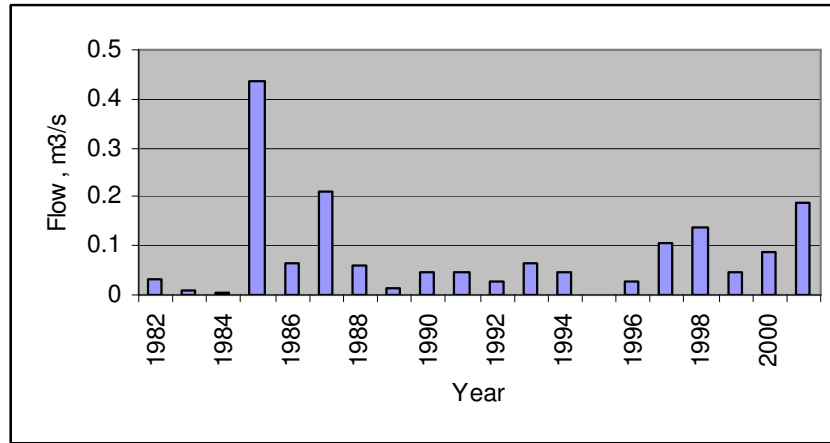


Fig.6.4 Monthly minimum flows for the River Enrick (1980-2001)

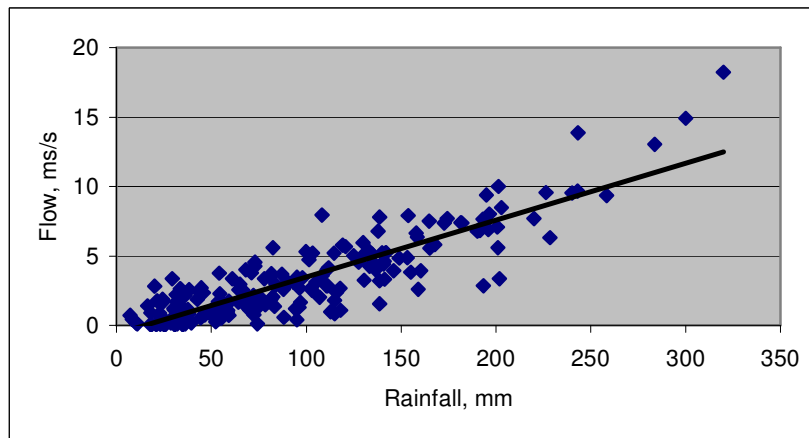


Fig.6.5 Relationship between monthly river flow in the Enrick and rainfall at Balnain

Potential effects

The indications from the River Enrick flow and rainfall records are that the period from 1990 to the present had much higher peak flows than the previous decade. The contribution of snowmelt to the highest flows is significant with monthly flows increased by some 20-50% by the melting snow. A recent report on the effects of changing snowfall patterns in Scotland indicates that snow melt events in the altitude range 300-600 m could become more frequent in the future. This would indicate that snow melt enhancement of floods in the Enrick could become greater in the future.

There is therefore no indication that the high peak flows are decreasing and it is likely that large floods will occur again. Management within the catchment must take this into account.

Q13 ► Views are sought on the issues relate to river flows and their potential effects in the catchment

7 Economic impact of recent floods

An estimate of the economic impact of floods since 1989 was carried out to quantify the damage done to domestic properties, impact on local businesses, damage to infrastructure and disruption to services. Much of the information needed for this type of assessment was obtained from anecdotal evidence. Some information could be inaccurate however important points such as memories of how a bridge was washed away or the cost of cleaning up after a flood, are usually clearly remembered. The economic impacts on domestic properties and private businesses were assessed by sending a questionnaire to all households and businesses which had been affected.

In May 2001 a questionnaire was sent to 38 households and businesses in the area. 20 completed forms were returned from locations throughout the Glen. A copy of the questionnaire is shown in Box 1.

The analysis of the questionnaires revealed a catalogue of impacts and problems related to the recent flooding. It also showed the large cost which householders have born to repair properties and rebuild flood defences. The analyses are summarised in the following tables. These results within the Consultation Report will be taken into the next phase of the Project where assessments will be made of the continued flood risk at each affected property and solutions presented to reduce the risk. These solutions will also be prioritised to enable a logical and effecting implementation to take place.

*Box 1 Questionnaire***River Enrick - integrated catchment management plan**

Mountain Environments has been contracted by The Glen Urquhart Land Use Partnership and The Partnership for Rural Inverness & Nairn to develop an integrated catchment management plan for the River Enrick. As part of this study we have been asked to carry out a survey of the economic impact of recent flooding. To achieve this we have developed this questionnaire which has been sent to all affected householders and local businesses in the area. In addition to the questionnaire we will be contacting all relevant agencies in the region to request information on the cost of repairs to bridges, disruption to services etc.

We would be very grateful if you could complete the following questionnaire and return it as soon as possible using the enclosed stamped addressed envelope. All individual responses will be kept in confidence and only summary information from all returns will be used in our reports. If you have any questions on this please contact:

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Economic impact of recent flooding from the River Enrick:

- 1 Name and address
- 2 How long have you lived here or how long has your business been located here?
- 3 What type of flood defences are near your house/land?
- 4 Has your house/land been flooded in the past? When?
- 5 What impact did the recent (since 1989) floods have on your house/outbuildings/land?
- 6 How did the flood-water enter your house/land?
- 7 What damage was caused to your house, contents or land?
- 8 What was the cost of the damage?
- 9 Has the flooding caused any other problems (e.g. loss of business, increased insurance premiums)

Analyses of the questionnaire:

i Number of people responding to the questions

Questions	Number of responses
How long have you lived here or how long has your business been located here	20
What type of flood defences are near your house/land	18
Has your house/land been flooded in the past – when	19
What impact did the recent (since 1989) floods have on your house, outbuildings, land	18
How did the flood water enter your house/ land	16
What damage was caused to house, contents or land	15
What was the cost of the damage	18
Has the flooding caused any other problems	19

ii Questions 1 - 4

Number years in residence	Types of flood defences near property	Previous floods	Impacts of previous floods
2	None	3-4 years ago	House, office and garden flooded
4	Garden wall next to river	1989-90	Garden and wall flooded
6	None	199?	River flowed over fields
7	River flood bank	1997	House, outbuildings and garden flooded
8	River flood banks	1999	Fields flooded; water table rising
10	Dry stone wall along river bank	1989/90; 1993	1989 – depth of 4-6 inches washed away building materials 1993 – adjacent land flooded
10	Boulders	1995; 1997	Fields flooded
11	Bund along ditch	1990; twice in 1990s	River Enrick flooded garden
12	Flood bank on opposite side of river; river bad cleared annually	1991; 1993; 1997 or 1998	Flooded drive and garden – including sewage
15	Wall around rear of property	Land flooded twice; house once	River flooded ground floor of house and garden; inundation caused sewage pipe to surcharge over land
17	River flood bank; wall built behind property	1989	Fields flooded
18	-	-	-
22	Sand bags	1995/96; 1997	1995/96 flooded house to depth of 10 inches
30		1989; 1990; 1998	Debris and gravel deposited over field
32	Rock boulders	Several times over past 20 years	-
33	Widening of Enrick	1995 or 1996	Minimal
33	None	1995; 1997	Outbuildings and garden flooded
49	Raised bank along river and edge of property	1960s; 1970s; 1989; 1990 (3 times); 1993 or 1994	Ground floor of original house flooded to depth of 4 feet; basement of present house floods
59	River flood banks		Fields flooded; ditch and river channel regularly silt up
60	River flood banks	-	Fields flooded

iii Questions 5 - 8

How did water enter house/land	Damage caused / repairs made	Cost of damage / flood defences (£)	Other problems
-	Damage to house	70000	-
-	River eroded bank making the garden and a wall unstable	-	-
River overtops banks	Frequent bank erosion resulting in loss of land – also flow of water over field with deposition of trees, boulders and rocks – expenditure to clear debris, reseed 8 acres of grassland and re-instating river banks	4500	Erosion of land which has planning permission for a 9 hole golf course – loss of business assets i.e. land and holiday lets – some land now un-insurable
Flood waters diverted along road – sandbags insufficient in number – water entered house through front door, air vents and up through floor	Damage to walls requiring new plaster boarding – outbuildings weakened – garden fence and gravel driveway washed away – damage to furniture, kitchen appliances	30000	Loss of business for 2 months
Water backed up from Loch Meiklie and the river channel – blockage in channel caused by logs and debris – flooding over fields	Land inundated and covered with debris - road damaged	-	Flood banks along the river are usually adequate as long as channel is maintained but water backs up from Loch Meiklie due to the blockage and raised exit from the loch – ongoing cost of clearing debris – fields are reverting back to marsh land due to the higher water table and frequent flooding
Over river banks	House under construction when flooded - building materials washed away; foundation height raised. Garden damaged. Septic tank flooded and blocked	3250	Insurance premiums for whole of IV63 increased as result of flooding

River overtopped banks	None	0	
Over the river banks	Bund build along ditch	5000	
Over garden wall – but not yet reached house	Garden wall seriously weakened – drive way surface washed away – plants damaged - septic tank will not drain away during wet weather due to high water table – backs up system potentially causing health problems	1030	Loss of income from both businesses
River overtopped floodbanks on the west side of the bridge – flowed over road and into house – water also has backed up through 2 storm drains	Serious damage to the ground flood of the house and contents - water burst open main sewer – raw sewage spread over land – damage to gardens – river channel from bridge to Loch Ness filled with debris	27000	Legal action taken against Water Authority to move main sewer – loss of business for 16 weeks – insurance premiums up by 161% - whole incident caused much misery
River overtops the floodbank	Fields flooded – driveway, fencing, trees and the flooring of stables lost in 1989	5000	River Board also cleared site and provided some rock for protection
-	-	-	-
Through the door and walls	Mud deposited over floors and lower walls	-	-
-	Damage to river bank	3000	-
Over river banks	Undermining of shop foundations	-	No direct costs but likely to be damage to building, loss of business and increased insurance
From west and east	Carpets, washing machine and fridge damaged	1000	
From the neighbours garden and directly from the river	Garden and outbuildings covered in silt – driveway gravel washed away - garden equipment damaged	70	Excess on house and contents insurance increased to £200
Over river banks due to poor repair of banks and debris within the river channel	Water damage throughout the old house with silt deposited over floors – large scour hole created in garden.	37000	Basement not now insured

	New house built higher but basement still floods from high water table		
River overtops banks and inundates fields	Flood bank breached in 4 places – 4-500 m of ditch silted up – ford regularly covered in sediment	4000	-
Back water flooding	Grazing land spoilt by silt and debris – river bank eroded – sheep lost	85000	Bridge over the main river had to be replaced

Summary of the issues:

1. Residents have lived in the area for different lengths of time and so have a wide experience of past flooding. Many people have been in the area for at least the past 12 years when the major floods occurred. Some families have been in the Glen for generations and hence there is a wealth of knowledge about the river stretching back for up to 60 years;
2. There are different memories of the years when flooding occurred but the general agreement is that the worst years were 1989, 1990, 1993, 1995, 1997 and 1998 (Fig.7.1). Therefore 6 of the past 12 years have had floods where damage has been experienced;
3. The types of flood defences in the Glen are wide ranging from flood banks along the river to flood walls constructed around individual properties;
4. Flooding has been due to three general issues. Both upstream and downstream of Loch Meiklie flood waters have overtopped the flood banks. In some locations this can be due to accumulations of sediment or tree debris in the river. Above Loch Meiklie there is a backing up of water from the loch and into the fields. During some flood events the attempts to divert flood waters in one location have caused flooding in another place;
5. The total cost of flood damage to domestic properties since 1989 is estimated to be £275850 (Fig.7.2);
6. Flood damage (Fig.7.3) has been caused to houses, their decoration and contents, to gardens and driveways and to agricultural land where valuable agricultural land has been lost, debris spread over fields, channels and ditches blocked and animals killed. In addition sewage systems have been affected with a main sewer burst and septic tanks unable to drain properly. This has resulted in the deposition of raw sewage over roads and gardens. Some impacts of the flooding are not measurable such as loss of access to fields or driveways or the distress caused;
7. Other issues in the Glen related to past flooding show the hidden costs involved. Upstream of Loch Meiklie the fields are reverting back to marsh land due to the higher water table and frequent flooding. There has been a widespread loss of business such as reduced holiday lets and restrictions in new developments. Insurance premiums throughout the area have increased both for private properties and for businesses.

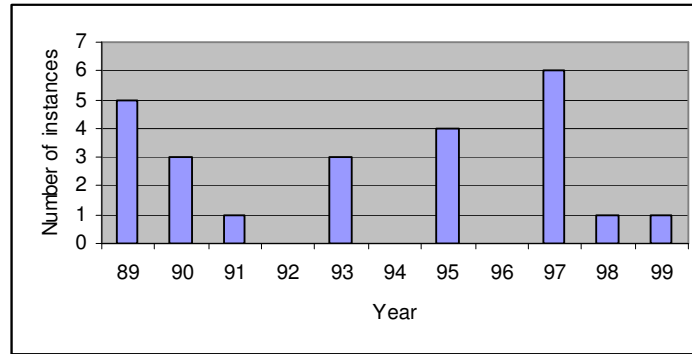


Fig.7.1 Number of flooding instances each year

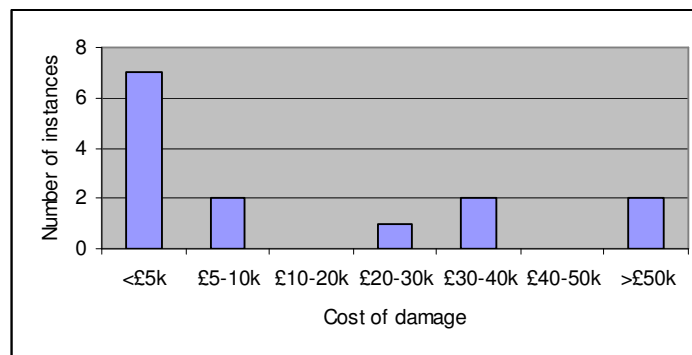


Fig.7.2 Number of instances with different costs of damage

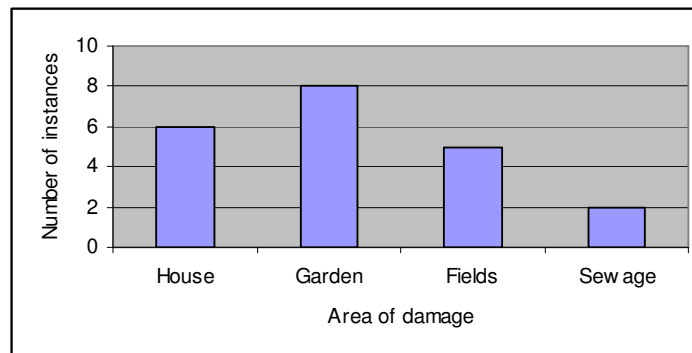


Fig.7.3 Number of instances of damage

Potential effects:

1. The high frequency of major floods in the past 12 years which have caused damage shows the seriousness of the past problem but it also indicated the possible frequency of major floods in future years. Flood management in the area should be working to this frequency of occurrence;

2. Flooding is caused by large volumes of water but the management of the river and its flood defences appears to be exacerbating the problem. There is an issue with the outlet from Loch Meiklie which is causing a backing up of water during high and low flow conditions and the greater inundation of the fields and higher water table. The flood banks are being overtopped in many locations, sometimes because of the accumulations of sediment or trees in the river channel. Protection of individual areas is sometimes carried out with no consideration for the properties downstream;
3. The costs involved are very high with damage estimated to have exceeded £0.25 million. The hidden costs are also excessive with insurance premiums now higher and many businesses losing trade.

Q14 ► Views are sought on the economic issues described and their potential effects

8 Next steps towards an action plan

This consultation report has identified the catchment management issues and potential effects which are of concern to the local community and to the agencies involved in management throughout the area. To develop the action plan these issues and effects will be reviewed to identify the common causes. A range of solutions will be considered with a benefit assessment carried out to identify the most appropriate. A programme of actions will be outlined as well as suggestions for the monitoring of the effects and administering the plan.

References

Halcrow (1990) River Enrich and Coiltie flood study. Report to Highland Regional Council.

Harrison, S.J., Winterbottom, S and Johnson, R.C. (2001) Changing snowfall patterns over Scotland. Report to the Scottish Executive, May 2001.

The Highland Council (2001) The Highland Structure Plan.

The Highland Council (2001) Inverness local plan: consultative draft, June 2001

RSPB (1998) Corrimony RSPB Nature Reserve: management plan