



# THE RIVER RESTORATION CENTRE 7<sup>th</sup> ANNUAL NETWORK CONFERENCE 2006

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HERIOT-WATT UNIVERSITY,  
EDINBURGH

## SUMMARIES OF PRESENTATIONS





## Summaries of Presentations

KEYNOTE PLUS SECTIONS 1, 2A & 2B

**SCOTTISH  
NATURAL  
HERITAGE**



**WWF**



## Seeking Ecological Outcomes from River Restoration

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### Summary

Recognition of the effects of past river degradation has led to widespread attempts at restoration. Worldwide, billions of dollars have been spent by private individuals, charities, trusts, industries and government organisations keen to take action. However, commentators point to a range of short-comings in current river restoration efforts (e.g. Ormerod 2004; Bernhardt et al 2005; Hassett et al. 2005; Lake 2005; Palmer et al. 2005; Wohl et al. 2005). Typical concerns are that:

- i) The visions and concepts guiding river restoration are insufficiently focussed on wider biodiversity, ecosystem services and ecological gain;
- ii) Restoration efforts are poorly co-ordinated and carried out at small scales rather than well co-ordinated across whole basins;
- iii) Limits imposed by ecological, hydrological and geomorphological context are often ignored or poorly understood;
- iv) The widespread assumption – that physical and chemical restoration is sufficient to engender biological recovery – is seldom tested;
- v) Criteria on which to appraise success are poorly developed or inadequately applied;
- vi) Appraisal of restoration outcomes are scarce, partial or short-term – particularly on ecological criteria;
- vii) Success is more likely to be judged as action rather than effectiveness.

Problems like these result in lost opportunities to maximise or demonstrate the ecological value of river restoration – in contrast to ecological restoration in other habitats. I argue that the Water Framework Directive is a major opportunity to better co-ordinate river restoration efforts to maximise ecological gain. I call for clearer guidance on the principles, design, targets and appraisal of river restoration in which statutory bodies and the RRC should have a major rôle.

### References

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## **Sustainable Flood Management Linking Engineering and Ecology**

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### **Summary**

The presentation will give an introduction to the work of the Aberdeenshire Flood prevention team and the pressures faced by a large Authority in a predominantly rural area.

It will look at the type of works that the team assess, and design, and how choices are made from both an engineering, ecological and environmental standpoint. This will include both form and material choices to protect and enhance the environment of the watercourse

A brief resume of how flood history is important and how flooding and flood prevention work effects both the environment of a watercourse and the community around it.

Working in watercourses will be addressed and details of what the team consider good practice will be demonstrated.

Following this a couple of Flood storage case studies will be highlighted at Mill of Gellan on the River Dee Catchment and at Fettercairn south of Aberdeen.

The talk will be completed with demonstration of techniques for ‘soft’ engineering on a few watercourses in Aberdeenshire.



## The Legal Basis for Restoring Rivers in England and Wales: an Environment Agency Perspective

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### Summary

Defra published its new strategy on flood coastal erosion risk management – *Making Space for Water* in March 2005. The strategy's aim is to manage the risks from flooding and coastal erosion through an integrated portfolio of approaches which reflect both national and local priorities, to reduce the threat to people and their property, and to deliver the greatest environmental, social and economic benefit, consistent with the Government's sustainable development principles.

Defra have established a comprehensive work programme to deliver the new strategy. A number of elements of this work programme are looking at the barriers and blockages to delivering the strategy's aim. A key issue for the Environment Agency is whether we have the legal powers and funds to deliver the vision of multiple benefit schemes which, for example, include river restoration.

In connection to main rivers, the Environment Agency has powers to maintain existing flood defence works (e.g. repair or otherwise maintain in an efficient state, existing watercourses or drainage works), to improve any existing works (e.g. deepen, widen, straighten or otherwise improve existing watercourses and works) and to construct new works (basically do anything required for the drainage of any land).

These powers are limited by what is covered by 'watercourse' and 'drainage'. Drainage includes defence against water, irrigation, warping, and the management of water levels in a watercourse for any purpose. Watercourse is defined widely and basically includes anything through which water flows. Therefore, many activities could be carried out as land drainage in terms of altering water levels (e.g. desilting, replacing gravel). However, whilst such activities could have conservation/restoration benefits, they must still relate to maintaining, improving or constructing new works. Whilst weirs and dams for example could be removed or altered, it would still need to constitute an improvement in terms of land drainage. It is less clear how works that have a neutral impact on drainage can be justified.

The Environment Agency has a duty to promote the conservation of flora and fauna. Furthermore, it may do anything that facilitates, or is conducive or incidental to the carrying out of its functions. However, this conservation duty does not give it the power to carry out works for nature conservation purposes, so anything we do for conservation is done via powers in other regimes such as flood defence or water resources

Funding of river restoration work is possible so long as the works relate to the Environment Agency's land drainage functions and powers. The costs would still have to be considered through existing spending rules. However, setting aside of a proportion of revenue money to be spent on addressing the environmental implications of the revenue programme as a whole, is legally questionable.

To conclude, it is currently unclear what works, which could help to restore rivers, can be delivered through existing Environment Agency powers and funding structures.

# Combining Ecological and Engineering Requirements for River Restoration within a National Nature Reserve: The Case of the Afon Teifi.

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## Summary

The Afon Teifi is one of the largest rivers in Wales and is of considerable national and international importance for a variety of biological and geomorphological features. It has been designated a Special Area of Conservation (SAC) and a Site of Special Scientific Interest (SSSI). In the upper section of the catchment, the Teifi runs through the Cors Caron National Nature Reserve (NNR), which is a wetland complex of raised bog, floodplain mire and swamp overlying a former lake bed. Within the NNR, approximately 1.5km of the Afon Teifi has been straightened and deepened. However, the course of the original channel remains obvious and much of it survives as an overgrown stillwater feature. This has led to a proposal to restore the river to its former course. In order to undertake the restoration the Countryside Council for Wales (CCW) required a river restoration plan to be developed.

The primary aim was to produce a plan for the restoration of the former channel within the NNR. This aim was met by incorporating environmental assessment, stakeholder consultation and engineering design into the plan, with specifications for pre- and post-project monitoring. This presentation will discuss how the ecological and engineering requirements for the restoration scheme were addressed.

Existing baseline data relating to river morphology and hydrology, vegetation, invertebrate and fish fauna, the floodplain, and the stakeholder interest were identified and assessed. Supplementary hydromorphological data were gathered and ecological surveys of the present and former river channels were conducted.

Following the data gathering and analysis, the beneficial and negative outcomes of the proposed river restoration were assessed using an environmental impact assessment (EIA) matrix. The design of the river restoration plan aimed to reduce negative aspects and ensure the benefits were maximised, whilst recognising that the main objective was to restore the river to its former course to improve aesthetic qualities and enhance biodiversity and naturalness.

A fundamental aspect that was incorporated into the restoration plan was the current conservation status of both the site to be restored and the river downstream from there and how the restoration process may impact this status. Before-After-Control-Impact (BACI) monitoring programmes were specified to cover: geomorphological and fluvial aspects (including sediment movement), vegetation, invertebrates and the fish community. These pre- and post-project monitoring data will be used to assess any changes in biodiversity arising from the restoration.

This project emphasised the importance of interdisciplinary working and highlighted the need for satisfactory pre-project baseline data for a river restoration plan.

## Making Space for Water – The Boscastle Experience

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### Summary

On August 16th 2004 a flood event, with a recurrence interval of 1 in 400 years, occurred in the River Valency valley, north Cornwall. The flood caused significant damage to the infrastructure within Boscastle which became the focus of media attention. The impacts of the flood, upstream of the village, have been less widely reported. The flood removed much of the anthropogenic modifications to the river throughout the catchment, including stone wall revetments, footpaths, wooden bridges and a weir. In addition, the river moved its course at several locations with large-scale erosion and deposition occurring throughout. The flood, has essentially achieved ‘natural’ restoration of the river and floodplain throughout much of the Valency valley. However, at the same time it has initiated a new set of processes that continue to re-shape the river. Post-flood, the key question is how should we approach the management of this newly naturalised landscape and the risks and uncertainties that are now faced?

There is a need to have a balanced approach to the management of the area upstream of Boscastle that recognises the ecological and geomorphological value of the newly formed landscape. We should not only be making space for water, but to sediment and woody debris as well. Upstream of Boscastle much of the valley is wooded. Many trees were uprooted during the flood but only a small proportion of these trees ended up in Boscastle. The large majority were trapped in the wooded floodplain either in wood-piles, where numerous trees were pushed together, or where the woody debris was trapped behind standing trees. Historic management of such systems has largely been driven by flood defence objectives with a highly interventionist approach being undertaken without recognition of the intrinsic value for habitat that floods can create. Recent research has highlighted the significant value of decaying wood in woodland systems and this has been a key driver for the National Trust in managing their land upstream of Boscastle. They have only undertaken low-key maintenance, removing broken trees within the immediate riparian corridor, and largely allowing natural processes to continue unimpeded. The successful retention of the woody debris features, on National Trust land, has had a significant effect on the increase in otter numbers observed in the catchment after the flood.

In the village itself, regeneration plans and a newly proposed flood defence scheme have needed to incorporate elements of risk and uncertainty into their design. The river is now over-widened upstream, compared to the natural ‘bankfull’ condition, and it is expected to narrow in time in response to deposition and vegetation encroachment. However, the flood incised the bed of the main River Valency in many places leading to knickpoint initiation up several tributaries. This has further been aided by failure of monastic terrace features in some of the tributaries. Secondary re-mobilisation of sediment is thus continuing upstream producing additional sediment into the system. The regeneration plans for the village have thus incorporated 1) the restoration of a meander bend upstream that will act as sediment and woody debris trap, 2) the relocation, and re-design, of the car park out of the 1 in 100 year flood envelope, 3) incorporation of a new riparian corridor and 4) the design of a new lower bridge that will reduce the risk of blockage. Haycock Associates Limited has advised the National Trust on management of their assets since the flood, in their role of soil and water advisors to the organisation.

## **Flood Management and Fisheries Habitat Enhancement – Side Effect or Efficient Co-operation?**

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### **Summary**

As an answer to flood events of the last decade, the development of new flood defence policies and their implementation have started. Structural flood management activities, like building or removal of dikes, reservoir buildings and interventions on floodplains, basically have impacts on habitats, including fish habitats. Following the successful river restoration programmes of past decades, habitat development, fish habitat developments have to be the part of new flood management activities. For the enhancement of fish biomass decreased by earlier habitat loss, for the enrichment of biodiversity, now an excellent and one-off opportunity presents itself.

Following the reconciliations with fishermen, fishery associations, owners and users of floodplain areas, water authorities, agricultural authorities and researchers, we worked out the strategic approach of fish habitat development serving the revival of degraded floodplain and the traditional floodplain fishery and floodplain management. On the other hand, this means developments directly linking to structural flood defence works. According to our research, a well-coordinated co-operation can result fish stock duplication (lower part of River Tisza, Hungary).

There's no doubt that the spontaneous/occasional effect of traditional structural flood management activity has to be replaced by a professionally and socially developed fish habitat development relating to flood defence activities both at local, regional and river basin level.

## **Balancing ecology and flood risk: Investigating the flood risks associated with gravel build up on the river Kent at Kendal.**

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### **Summary**

The Environment Agency has a responsibility to manage flood risk and to assess options for flood risk mitigation. This includes Flood Alleviation Scheme (FAS) design and construction, and involves maintaining such schemes, where required, to maintain the conveyance capacity of such channels. Historically, maintenance has often involved wholesale removal of gravels, which are often valuable habitat. The river Kent is a designated Special Area of Conservation (SAC) and SSSI for its riverine flora and fauna. Sediment deposition is a natural river process and is related to channel hydraulics. Deposition occurs at the inside of bends, or where the channel widens, or gradient lessens. Consequently, once removed, shoals often reform. The Environment Agency has produced a gravel removal policy which states that: 'The EA is generally against the removal of gravel from rivers, other than for navigation or where proven to be essential in specific locations for flood risk management or water supply purposes.' The policy requires that practices are sustainable and environmentally acceptable over the long term.

Determining the precise impact of sediment accumulation on channel conveyance is a complex issue, especially given the three dimensional nature of flow in channels, which is particularly difficult to assess around bends. Despite these complexities, hydraulic modelling using a 1-D hydraulic model was undertaken to look at gravel accumulation at deposition bars within the Kendal scheme, in an effort to determine build-up levels that would start to affect flood risk. The aim was to achieve a sustainable balance between sediment build-up and habitat, in order to try and define a sustainable maintenance programme.

## **River Sediments and Habitats and the Impact of Capital Works and Maintenance**

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### **Summary**

Capital works and maintenance have, in the past, been carried out often with little regard to the impact of the activities on the sediment dynamics of a river at reach and catchment scales and the resulting implications for habitats. Channel maintenance, in particular, is carried out with the objective of maintaining channel conveyance and providing land drainage but the approaches to carrying out maintenance are not always sensitive to sediment and habitat characteristics of the river. HR Wallingford is leading an EA/DEFRA R&D project which involves a number of other specialist consultants and is looking at developing methods and advice on best practice for carrying out capital works and maintenance. Work that is effective, minimises the adverse impacts on the environment and potentially brings benefits for the sediments and habitat characteristic of a river.

This presentation will outline the objectives and progress to date of this research project. The work is of three years' duration; having started in March 2005, it will finish in March 2008. The project is examining five case study rivers in detail, each typifying different river characteristics and each from different Environment Agency Regions. The case studies are:

- The River Kent in Cumbria, where gravel shoal removal is carried out.
- The Long Eau in Lincolnshire, where weed cutting is carried out.
- The River Dearne in South Yorkshire, which has a two stage channel and is dredged annually.
- The River Harbourne in Devon, where there has been construction of a flood storage reservoir and some channel improvement works.
- The River Eden in Kent, where weed cutting and sediment removal is carried out.

Data was collected at each of these sites in summer 2005 and an ongoing programme of data collection over the next two years will monitor the impacts of the experimental phase of the project which will aim to test different approaches to managing each river. It is intended that the lessons learned on these case studies will contribute to scientific understanding of the relationships between capital works, maintenance, sediments, habitats and ecology and will feed into best practice advice for the Environment Agency.

## **Managing Berms in Channel Maintenance: Making Room for Flood Flow and Biota**

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### **Summary**

In Ireland, channel maintenance in major arterial drainage schemes is undertaken by the Office of Public Works (OPW). In the initial arterial drainage, reprofiling can lead to an increase in base width and in cross-sectional dimensions in a channel. Natural fluvial processes, in these circumstances, can lead to deposition of bed material and formation of lateral berms. Such deposition can accumulate until it impacts significantly on the channel form and flow characteristics. Commonly, the channel develops a two-stage form, with low flows entrained in a narrow inset channel and flood flows filling the cross-section. Such a sequence can create habitat opportunities for river corridor biota as well as leading to reduction in conveyance capacity for flood flows. Studies of maintenance impacts on biota in such two-stage channels have identified impacts of different treatments on brown trout and on vegetation assemblages. These studies have identified an optimal strategy for maintenance in areas with berms and this strategy forms a part of OPW's current environmental protocol for channel maintenance. The approach is based on retaining the narrowing and deepening effect of the inset channel while providing easement for flood flow at a higher level in the cross-section.

# **Consultation Procedures for the Protection and Enhancement of Fisheries in Watercourses Designated for Drainage Maintenance in Northern Ireland**

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## **Summary**

A land drainage programme commenced in the late 1940's in Northern Ireland. The programme has made a significant contribution to the improvement of land productivity. In removing or reducing flooding problems it has benefited agriculture, industry, transport, commerce and housing. It has been acknowledged that this benefit has been at some cost to inland fisheries and the conservation value of river corridors. Procedures have been developed whereby fishery protection and/or mitigation measures are built into the design and execution of drainage maintenance works and where stakeholders are involved in the process. The evolution of these procedures and development of fishery improvement schemes are examined and illustrated by reference to examples. The approach is set in the context of the EU Habitats and Water Framework Directives.



## Summaries of Presentations

### SECTIONS 4A, B & 5



# Stream Power – a Practical Tool for River Restoration and Management, with Specific Examples from the UK

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*(with contributions from Suzanne Hewitt, Duncan Wishart, Angela Boitsidis, Sally Kelday and Joanne Barlow, all geomorphologists at Jacobs Babtie)*

## Summary

Stream power has been recognised by fluvial geomorphologists for more than four decades as an important independent ‘control’ variable that determines adjustments of river morphology. It may be defined in its simplest form as the rate of energy expenditure per unit length of channel (the rate of doing work) and is a function of both the channel slope and water discharge. Stream power interacts with sediment properties to determine rates of sediment transport and the stability of the channel bed and banks. In the last two decades stream power has been used by some geomorphologists as a practical tool to determine the potential impacts of river engineering strategies and schemes and the appropriateness of restoration techniques to particular river types.

This paper proposes a wider and more routine application of stream power by river managers (including ecologists), particularly as an initial screening or desk study tool. Undertaking a broad calculation of stream power requires data that can be collected relatively rapidly. Both the published river restoration literature and more recent river problems involving erosion or deposition from around the UK are examined. This data has allowed update of a series of predictive tools that plot bankfull discharge against channel slope for different ‘channel types’. Generally lowland river channels with very low stream powers have a tendency to experience deposition of fine sediments whilst high stream power river channels in floodplain sediments have a potential for erosion. However even very weak sediments in lowland river channels may have a tendency to erode and case studies are presented.

Used as a screening tool, stream power calculation (together with knowledge of sediment type) can give a broad indication of whether a channel has the potential for erosion or deposition, leading to completed restoration projects that should require minimal ongoing maintenance or that have been designed to adjust in an adaptive fashion.

## Overview and Demonstration of the “River Rehabilitation Guidance for Eastern England Rivers”

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### Summary

This paper describes guidelines developed for restoration or rehabilitation techniques within Eastern England Rivers. Within the Anglian Region of the Environment Agency many of the river systems are identified as being in a poor state and the opportunities for improvement are plentiful and the benefits they bring are significant. The majority of restoration work that will be planned and undertaken in the Anglian Region is rehabilitation and enhancement rather than restoration. It was identified that planning of the rehabilitation is best done on the basis of broad assessment backed up with scientific proof, through different techniques, and experience where appropriate and necessary. There are times when modelling may be necessary and/or guidance from more experienced personnel needed. However, unnecessary expenditure on modelling and design is wasteful of resources and may stifle the recognition of opportunities to make a significant enhancement to the environment.

These guidelines provide stand alone description of the main generic techniques used in the rehabilitation of Eastern England rivers, their background and intention, effect on the river and surrounding land and possible issues that may raise. This is then supported by an assessment of the hydraulic implication and risks of such in-channel works, the options currently available to model them and their appropriateness.

Where applicable, case studies are used in the guidelines to demonstrate the techniques what modelling may be required and its usefulness. The new Agency adopted Conveyance Estimation System (CES) is used in the case studies to show how this can help to determine likely changes to river and flood flows for different techniques.

The paper describes, generally, the in-channel techniques within the manual and demonstrates, specifically, how case studies and simple models such as the CES are being successfully and simply applied to assess the impact of some of the techniques covered.

# Developing an Engineering Strategy for Catchment-Based River Restoration using Geomorphological and Ecological Principles

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## Summary

The River Dour (Kent) is a spring-fed chalk stream in a dominantly urban catchment. The main source of the river rises at Watersend Pond in Temple Erwell within the Lydden Valley, whilst the Alkham Bourne drains the Alkham Valley and rises from perennial springs at Bushy Ruff and Kearsney Abbey Lakes. Once these two streams form a confluence at Kearsney Abbey Lake the river flows through the centre of Dover before ultimately draining into the English Channel at Wellington Dock.

The River Dour appears to have a relatively natural gravel bed. However, the majority of the river has been formalised through the use of bank protection with the predominant use of concrete banks. Additionally, the relatively steep gradient of the river (10m drop over 10km) has been utilised by the construction of a number of mill and weir structures. These relatively redundant structures now heavily impact on the conveyance of water, sediment, and the migration of fish. Survey has shown that the historical management of the river has greatly influenced the geomorphology of the contemporary system, resulting in a degraded river with an impoverished ecology.

Currently the cost of catchment-wide river restoration is generally beyond affordable budgets. Therefore, there is a requirement to strategically assess the current condition of the river in terms of geomorphology to identify the potential for restoration. By adopting this sustainable long-term approach to restoration, all reaches will be prioritised providing the best use of resources.

Reach based river restoration, whilst sustainable and affordable at the individual reach level, may not address the rivers greatest need at a catchment scale. Therefore, for discrete reach restoration to be sustainable, it needs to be based on sound geomorphological and ecological principles allowing rivers to promote and maintain the desired and appropriate habitats.

The use of the Geomorphological Assessment technique provides a consistent method of assessing each reach, and so giving an understanding of the system as a whole. The technique provides a method for measuring each reach's geomorphological patchiness (number of different features present) and geomorphological diversity (the product of patchiness and total number of feature occurrence). By comparison, the diversity deficit for each reach can be determined by comparison to the best reach.

The restoration effort can then be tailored to supply the identified deficit using appropriate restoration techniques. The costs for the supply of these restoration benefits for each reach can then be determined. By ranking the restoration benefit to cost ratio of each reach in descending order, the most effective sequence of restoration can be seen, allowing a rational strategy of river catchment restoration to be developed.

So, by assessing the river in relation to its geomorphological requirements the most appropriate engineering solutions can be identified and schemes designed to provide the 'missing' physical features, ultimately resulting in the development of appropriate ecological habitats.

## The challenge of sediment quality management in urban river restoration

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### Summary

Implementation of the Water Framework Directive and the current debate on the management of sediment has led to the emergence of a possible conflict between the socio-ecological goals of urban river rehabilitation and the risks to public health that may be associated with increased access to rivers which in many urban settings are known to contain contaminated sediments. It is within the context of this contentious area that this paper sets out to discuss the benefits of opening-up urban rivers (both physically and socially) in relation to the possible hazards associated with the presence of contaminated sediments. Data on urban sediment quality data will be reviewed together with current approaches to river restoration in urban areas, using examples from rivers within the Greater London area as an example. Using this information, an integrated social and physical sciences approach to identifying and addressing potential concerns and needs is proposed.

# **‘Integrating Sustainable Drainage Systems into River Restoration’**

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## **Summary**

Sustainable Drainage Systems or SUDS is a new approach to managing rainfall on development that considers the Quantity, Quality and Amenity aspects of drainage equally.

SUDS uses a suite of techniques and structures (including filter strips and swales, filter drains and permeable pavement, basins, ponds and wetlands), to manage rainfall by controlling flooding, preventing pollution and providing benefits to the community and environment.

SUDS also uses the concept of the ‘management train’, with control techniques in series to enhance the character of runoff, as well as drainage at a sub-catchment level and ‘source control’ that all contribute to the effectiveness of SUDS.

Although most recent SUDS schemes in Britain have been limited to individual sites with limited impact on whole catchments, the planning of SUDS at regional development level is now being undertaken more commonly to protect the environment.

However, despite the underlying philosophy that SUDS should mimic natural drainage, runoff from SUDS schemes is still often conveyed in a pipe sewer to be discharged at convenient locations outside the development envelope. This arrangement can result in cross-connections to sources of pollution or allow silt and chemical contaminants to bypass SUDS techniques into local watercourses. The value of water to the community is also lost when water is conveyed underground rather than on the surface through urban landscape to benefit people and wildlife.

This presentation considers the use of SUDS at the sub-catchment level to provide controlled and clean headwaters to urban catchments. It considers the use of urban watercourses to convey controlled flows through urban space and the discharge of runoff into ‘constructed wetlands’ that ensures runoff from development enters watercourses in a way that mimics nature.

Current housing and school projects will demonstrate how these objectives can be achieved in practice with an overview of how new settlements can protect and enhance watercourses that receive the runoff from new development.

## Linking Remediation with Restoration

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### Summary

As the development of 'brown field' sites gathers momentum, those involved in the ecological restoration of rivers and their floodplains need to take account of the contamination often associated with such sites. Numerous technologies are available for *in situ* remediation of contaminants but these can often be compromised if associated river restoration enables a stream system to regain its natural dynamics. Such issues can be complex to resolve and the subject of this presentation looks at a combined land remediation and river restoration scheme using a variety of techniques.

The project concerns Boundary Brook where it flows through Farrington Hall Wood in Leyland, Lancashire. The form of this steep sided wooded valley was created through the continuous dumping of industrial wastes over several decades. This waste was made up of ash and clinker combined with metals, dyes, rubber products and solvents. As the tip became abandoned some 50 or 60 years ago a sycamore dominated woodland developed, totally shading out the stream channel in its canyon of contaminated earth. The wood became a local amenity, used by children and walkers, and was placed under a Tree Preservation Order in 1990. When the owners of part of Farrington Hall Wood came to dispose of their land assets in the area, they became aware that the trees in the woodland were showing signs of stress and many had fallen, exposing significant areas of contaminated materials. With such potential human health risks associated with the land, remediation needed to be undertaken before the land could be sold.

Various options were considered for remediation of the land but in the end it was decided that the most environmentally sustainable approach was to remove, treat and appropriately dispose of the waste. However, as the wood was owned by two separate landholdings only the valley to the north of Boundary Brook would be remediated.

The scheme involved the remediation and restoration of the stream bed and the return of the flood plain and valley form to its original state, on one side only. Risks of contamination from the wood to the south of the stream have been dealt with using soft engineering techniques and the enhancement of the flood storage capacity of the restored flood plain. From a biodiversity perspective the scheme, completed in spring 2004 is proving successful. Aquatic invertebrates, almost absent prior to restoration, have begun to re-establish themselves and the flood plain is evolving as a diverse wetland habitat with associated dry woodland and grassland slopes. Translocation of recovered bluebells and other woodland plants has worked well and the terrestrial invertebrate assemblage shows a typical flush of species in the newly established habitats.

In 'brown field' situations, river restoration needs to balance the aspirations for biodiversity and stream function with sustainable environmental protection. Where such a compromise has to be struck, soft engineering techniques can often provide the solution.

## **New Controls on River Engineering in Scotland**

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### **Summary**

The recent Water Framework Directive characterisation exercise for Scotland highlighted a substantial impact from engineering activities in rivers. Approximately one third of all rivers were shown to be at risk of failing WFD objectives due to physical alterations. This presentation introduces new regulations designed to prevent further deterioration in the quality of Scottish rivers. This presentation gives an overview of the new regulations to control river engineering, which come into affect on 1<sup>st</sup> April 2006. For the first time, the regulations will establish a national framework for managing physical alterations to rivers, with three key goals;

1. Manage ecological quality of rivers (as defined by the Water Framework Directive) to allow for sustainable development
2. Manage risks to conservation areas, biodiversity and protected species, and
3. Promote sustainable flood management.

The regulations are strongly risk-based and will be underpinned by new scientific tools aimed at developing our understanding of links between river ecology and geomorphology. The regulations will apply equally to restoration as well as more traditional engineering operations in rivers. The presentation will be used to show how the new controls will support everybody involved in river management in Scotland to improve the quality of our rivers.

# A Morphological Impact Assessment Tool to Support WFD Implementation

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## Summary

Under the Water Framework Directive (WFD), previous drivers for aquatic management (including fisheries and flood protection) will be accompanied by a requirement to attain and maintain ‘ecological status’ objectives. ‘Status’ objectives are met when biological, physico-chemical and hydromorphological criteria are achieved. To allow UK agencies to assess whether new river engineering activities represent a threat to achieving WFD status objectives, there was a requirement to develop a new tool that could be used to screen the risk posed to morphological and ecological health from different engineering activities.

This presentation summarises the outputs from a recent SEPA/EA work programme. The overarching aim of this project was to develop a simple, practical decision support framework for determining, whether:

- (i) A new river engineering activity on, or in the vicinity of, a surface water is liable to result in a deterioration in ecological and morphological quality;
- (ii) The extent of existing morphological alteration within the affected reach is likely to be compatible with the achievement of good or high morphological and ecological status.

The project was to cover direct morphological alterations- i.e. engineering works and other activities on or in the vicinity of rivers- and to consider how alterations to the surrounding landscape affect channel reaches and the ability for channels to absorb further impacts. In Scotland, the outputs from this project will be used to support implementation of new regulations to manage river engineering activities.

The decision support framework outlined in this presentation centres on the principle of ‘channel capacity’. In summary, this concept assumes that rivers have a ‘capacity’ to absorb impacts, and that anthropogenic activities within rivers, or in the surrounding landscape, exhaust some of this available capacity. By determining how much available capacity is expended by different pressures, it is possible to determine the total level of impact on a channel at any point in time. Morphological condition limits can then be used to define permissible levels of impact on a systems available capacity that are compliant with WFD status classification boundaries.



DAY 2  
Summaries of Presentations

KEYNOTE PLUS SECTIONS 6, 7A, B & C



## Sustainable Flood Management: an Engineer's Viewpoint - Preaching what we've always Practiced?

Ronnie Falconer, [ronnie.falconer@jacobs.com](mailto:ronnie.falconer@jacobs.com)

Senior Consultant Flood Risk and River Basin Management, Jacobs Babbie

### Summary

Climate change will have serious implications for the economies of Europe, the UK and Scotland. It is expected that flood risk will increase for all types of flooding – fluvial, pluvial, sewerage, coastal, estuarine and groundwater, potentially at least doubling the risk in some areas in Scotland before the end of the century.

It is essential that we manage these impacts in a way which is sustainable to maintain the health and well-being of the population, the environment and the Scottish economy. Sustainable flood management (SFM) is at the heart of this strategy and is underpinned by a holistic approach to Europe-wide integrated river basin management in harmony with the aims of the Water Framework Directive and the proposed new Floods Directive.

The Water Environment and Water Services (Scotland) Act 2003 places a duty on Scottish Ministers, SEPA and local authorities to co-operate with each other to promote SFM but does not provide a definition of SFM. In November 2003 the National Technical Advisory Group on Flooding Issues (NTAG) was established by the Scottish Executive. NTAG developed the following definition of SFM together with a set of 12 Principles.

*“Sustainable flood management provides the maximum possible social and economic **resilience**\* against flooding, by protecting and working with the environment, in a way which is fair and affordable both now and in the future.”*

(\* **‘resilience’** means: **‘ability to recover quickly and easily’**. The Scottish Executive uses it to deliver the **‘Four As’**: Awareness + Avoidance + Alleviation + Assistance.)

In April 2005 the Flooding Issues Advisory Committee (FIAC) was set up to continue the work of NTAG and advise on SFM implementation, including a pilot project and consultation. Based on consultation and feedback from a number of workshop sessions the SFM Principles are in the process of review. At present it is likely that the Principles will be broadly similar to the 10 set out in the draft outline reproduced in Table 1. Achieving compliance may well be based on a written statement demonstrating compliance together with a simple colour coding system. SFM compliance will be a requirement of the Controlled Activity Regulations 2005 which will be implemented by SEPA and come into effect in April 2006.

A range of example projects have been used to test the application of these Principles and it is interesting to note that many flood management schemes and projects completed in recent years score well against the draft modified Principles. This demonstrates that without consciously applying SFM principles at inception, feasibility, design and implementation stages engineers have in many cases adopted and applied sustainable approaches which are consistent with the draft modified Principles. In particular, approaches which have been applied often include:

- A catchment wide holistic approach including upstream options such as storage.
- Recognition of climate change and allowance for a higher level of protection incorporated (either now or in the future).
- Awareness of environmental sensitivities and early consideration of issues and means to mitigate environmental impacts.
- Consultation with key stakeholders and with the public from an early stage.
- Costing on a whole life basis.

## **The River Tummel: a Site with Present-Day High Ecological Status Following Recovery from Historical River Engineering**

*David Gilvear, Email: DJGI@stir.ac.uk*

*Nigel Willby,*

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### **Summary**

This presentation will describe the physical and ecological characteristics of an 8 km river reach of wandering gravel-bed river with high ecological status and high conservation value. The site is interesting in that during the later part of the 18<sup>th</sup> century and throughout the 19<sup>th</sup> century it was subject to river engineering principally in the form of flood embankment construction. However since a large flood in 1903 it has been allowed to revert to a more natural river system. This change has been documented with reference to old maps and aerial photography. Studies have also been undertaken to examine the importance of 20<sup>th</sup> century bank erosion, channel migration and avulsion and resultant influence on the fluvial features present on plant diversity (both terrestrial and aquatic) primarily but also animal species. The site has high plant species richness including locally and nationally rare species. In particular the talk will focus on recent research linking the vegetation development of a reach to the evolution of a large complex gravel bar that has formed over the last 15 years.

Based on the information presented above comment will also be made regarding the influence localised 20th century engineering, upstream impoundment and climate change on the future nature conservation value of the site. Overall the presentation is aimed at enlightening the audience as to the role of geomorphic processes in creating river corridors of good ecological status and the environmental impact of river engineering.

# Application of Sediment Impact Assessment and Adaptive Management Techniques to Develop Sustainable Flood Management Solutions.

Matthew Hardwick

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Professor Colin Thorne, *The University of Nottingham, University Park, Nottingham. NG7 2RD email: Colin.thorne@nottingham.ac.uk*

## Summary

Many streams throughout the UK have depleted physical stream habitats due to centuries of insensitive land-use practices, agriculture and flood defence. Such adverse activities have had a significant impact on the hydrology and sediment regime of the catchment, producing channels with low flood capacities and low ecological diversity.

The use of best practice geomorphological survey techniques, such as Fluvial Audits and Conservation Baseline Assessments, coupled with Sediment Impact Assessment using methods currently being developed by the Flood Risk Management Research Consortium ([www.floodrisk.org.uk](http://www.floodrisk.org.uk)) to assist in understanding of the sediment processes and morphological forms within river systems, can help meet the information needs of river engineers, ecologists and designers.

This paper illustrates the utility of these techniques using a case study from the Rothes Catchment, Morayshire, demonstrating how these techniques nest within a multi-disciplinary approach to reducing flood risk. The approach has informed development of a more sustainable flood alleviation scheme in the following ways:

- Fluvial Audit – archival and field reconnaissance illustrated sediment-related problems and the main risks to a Flood defence scheme.
- Sediment Impact Assessment – tool for appraising and developing the options – locations of erosion and deposition, bed elevations for design of structures.
- Assisted Operation & Maintenance - deciding ‘where’, ‘what type’ and ‘over what timescale’ channel maintenance will be required.
- Evaluation criteria - enabled development of design guiding principles.
- Design – prioritise reaches for rehabilitation and identified reference reach and assisted in selecting appropriate rehabilitation and stabilisation measures

Such methods will enable the implementation of a sustainable flood management scheme which conforms to the Water Framework Directive, and reduces future capital works and maintenance, working with, not against natural processes.

## **River Restoration and Engineering at the River Lech (Tyrol, Austria) in the Context of a LIFE-Project.**

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### **Summary**

The Tyrolean Lech Valley with the River Lech and its tributaries is one of the last near natural Alpine riverine ecosystems of Austria and because of its size and character one of the most important ones for whole Central Europe. It is endangered by various impacts. For example River regulation and bedload deficits caused by debris dams in the major tributaries resulted in serious erosion and sinking of the river bed. The sinking did not only lead to further negative impacts on the fluvial system as, for example, separation of the Lech river from its side waters, the fall of the groundwater level and dry-running of floodplain areas, but also caused problems regarding protective structural measures (washout of the riverbank protections, etc.). Thus, not only are the rare plant and animal species endangered but, to a certain extent, the settlement areas in the upper and middle reaches too. At the same time the main settlement in the lower reach is endangered by gravel accumulation.

Thus some major goals of the EU-LIFE-Project "Wild river landscape Tyrolean Lech" (one of the largest ever granted LIFE-Projects with a total budget of €7.82 million., consisting of 53 single projects) are:

- Conserving and restoring the fairly natural, dynamic fluvial habitats
- Stopping the sinking of the riverbed and fall of groundwater level
- Improving flood protection in accordance with environmental protection regulations

A delicate balance in the bedload management has to be obtained, as in the upper and middle reach. gravel is needed to maintain the highly dynamic, braided river type; whereas in the lower reach a bedload surplus would be a severe problem. So a whole set of well coordinated measures is needed to fulfill all these requirements:

- Broad river widenings as measures for flood protection and river revitalization at the same time
- Removal of some large debris dams in big tributaries to improve the gravel-balance (resp. fight the actual gravel deficit) in the main river
- A big bedload-entrapment, which is at the same time improving the ecological situation, as an innovative project to protect the main town in the district from the possible bedload surplus (which is in part also consciously caused by our measures in the upstream reaches).

Details and experiences with these mostly finished measures, last but not least in the course of a 300-years flood event in August 2005, are presented.

## **Catchment Management - Community Demonstration Project proposal based on the river Euchar catchment south of Oban.**

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### **Summary**

This paper will set out what the issues are for catchment management for the river Euchar, south of Oban, Argyll taking account of the influences on the land, freshwater and marine environment. The project was part of a European funded Community Action for Biodiversity demonstration project.

The aim of the project and the published guidelines for the Euchar is to provide a tool to help in the formation of other catchment management plans in Argyll & Bute. Whilst it is accepted that each individual catchment will have varying influences and different management systems in place, it should be acknowledged that catchment management is a process that will require co-operation by all interests in order to ensure that good quality resources are sustained using biodiversity as an indicator.

The guide will be used as a means of supporting a range of important habitats and species identified in the Argyll & Bute Local Biodiversity Action Plan and as a way of illustrating the relationship between and integrated approach to catchment management and optimal biodiversity.

The Euchar catchment was chosen as being representative of Argyll in terms of dynamics, geology and climate. Having a total area of approximately 64 square km and rising from sea level at Loch Feochan to between 450 and 500metres on Ben Ghlas, most of the land is rugged hill country with lowland dominated by glacially scoured Glen Euchar. Almost the entire catchment is underlain by andesite (Dalradian) rock which breaks down to moderately fertile soils in places. Glacial and fluvio-glacial deposits are abundant from Musdale to the sea at Loch Feochan whilst other areas in the Glen are influenced by high rainfall and a moderate climate, results in the build up of peat on poorly drained ground.

To provide you with a better insight into the Euchar catchment, I will give you an insight into the operations that take place there, the natural heritage/ biodiversity, the community and recreational activities. I will discuss the issues for the Euchar which are water quality, river water management, fisheries management, habitats and species, farming, forestry and woodlands and community, recreation and access. These will be illustrated in terms of management objectives and action, and finally, I will give an outline of proposed action in the form of a project which will be delivered under the banner of Phase II Community Action for Biodiversity.

## **Ecourbanism : The Aesthetics of Restoring Green Heritage in the Built Environment**

*Luke Engleback MLI*

*Principal of Studio Engleback, environmental design group*

*Professor of Landscape Architecture Bergen Arkitekt Skole, Norway*

*Chairman of the Landscape Foundation*

*Gary Grant MIEEM*

*Director Ecoschemes Ltd, design associate for studio engleback*

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### **Summary**

Linden Homes and lead architects John Thompson & Partners invited Studio Engleback to provide the environmental design input to a proposed housing project near Redhill, Surrey, located in a former sand quarry and sand washing plant. Gary Grant MIEEM provided the ecological input, and Cameron Taylor Bedford were the engineers.

The site is located on the edge of the London Metropolitan Greenbelt and adjacent to a post minerals mining valley restoration area called the Moors Project. The architect's concept of a compact village style development for some 500 homes was developed on the basis of character zones and the idea of 'water at every turn'. A brook flowed through the site under the sand washing plant in a pipe and flowed into settling and balancing lagoons. The adjacent Redhill Brook, is part of the river Mole system which is known to be 'flashy'. The London to Brighton railway (on an embankment that forms a boundary the site) also divides the floodplain, causing flooding in the Moors during heavy rainfall. The site for development is just above the 100 year floodplain and so compliant with PPG 25.

Our original intention was to restore the brook as a 'blue spine' feature that ran through the site and would also act as the collection point and filter for a Sustainable Drainage system for surface water, with the former lagoons restored as a nature reserve acting as a buffer before discharge into the river system. The idea of a housing scheme informed by ecology and natural forces was appealing but difficult to achieve. This paper outlines the problems encountered, not least in 'when is a stream not a stream....'

Problems of levels and a minimum 5m access to the brook which will soon to be moved from Local Authority to Environment Agency jurisdiction, soon raised an number of issues. What is 'natural', what edge treatment is appropriate in a compact settlement, the conflict of building proximity for reflections of the facades versus a 5m minimum access, and whether the restored stream was to be 'on line', or a 'water feature'.

It became necessary to create a separate channel for the brook at the edge of the site when the blue spine had to be 'off line', and due to space resections this would have to be constrained over part of its length before a more natural profile could be adopted as part of the public open space element of the scheme. The edge treatment of the restored stream as well as access then became a major issue.

The brook had been little more than drainage ditches shown on early OS maps, so we took the opportunity to put back meanders and micro topography appropriate to a Wealden greensand location with acid mire and adjacent lowland heath fringes and acid grassland. The wet areas were also designed as a wet fence to deter access to the closed lagoons nature reserve as well as an accessible and biodiverse component of the open space provision and overall landscape character for the scheme.

# **Stream Naturalisation in Illinois, USA: Integrating Geomorphology, Technology and Local Communities to Improve Physical and Ecological Habitats in Illinois Streams.**

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## **Summary**

This paper gives examples of two stream naturalisation projects undertaken near Chicago, Illinois, USA. These projects exemplify the need for interdisciplinary awareness and the critical need for communication between designers, contractors and local communities in order to maximise morphological and ecological functioning of stream systems. The paper directly approaches the themes/issues central to this conference, particularly; ‘The need for stability through engineering... and creating or maintaining a dynamic river that has a high ecological value’. The examples given in the paper will show one successful example of maximising hydromorphology and ecology within a constrained urban setting, and one example of re-meandering of a stream in a low-income urban green space and flood-risk area.

## The New Wien River Project – the Urban Reach from Auhof to the Danube Canal

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### Summary

This project started in 1987 and is still in progress. Decisive factors for the project were extensive hydrological and hydraulic preliminary studies carried out approx. 20 years ago. These studies showed that the Wien river regulation, which was built around the turn of the last century would not provide sufficient flood protection in case of an extreme flood event. Moreover the way the river regulation was done at that time does not meet contemporary river management requirements, where issues such as river ecology or recreational uses are getting more and more important besides water management objectives. In this context water protection, especially water quality is an important issue. On this account flood and sewage bypass channels are planned by the city of Vienna to avoid future overflows of the existing sewage system. The project “revitalization of the Wien River” includes the whole reach of the River Wien and Mauerbach within the city, where the area Auhof – Mauerbach with the retention system can be seen as the core. The task of these installations is the retention of extreme flood events, which have been flooded over fixed – crested weirs from a certain flood wave.

A full reorganisation of the whole area deals with the following main problems. How can the retention capacity of the reservoirs be increased and respectively the flooding of the flood storage reservoirs by tributaries be avoided? Another question was to create a setting by appropriate measures for a development of a nature-orientated and typical river system. Today both the Wien River and the Mauerbach run in their original river beds up to a discharge of a 2-year flood in the relative retention areas. Just in cases of high floods they are directed into the bypass channels to keep the flood storage reservoirs for the peak flow. Consequently the width of the Wien River increases from 20 to 200 m for a reach of 2.8 km. To guarantee the maximum storage use, there should be an individual regulation with a movable closure. Inside the reservoirs the events are left on the river’s own resources. Basic conditions, as the surrounding walls, dykes and slopes and the regulative closures of the weirs, from the framework within the river can develop independently. Due to the different inclines of the individual reservoirs, several river morphological processes can be observed. In contrast to the measures inside the reservoirs which contain only corrective maintenance, the measures in the bypass channels are the replacement of the paving by adequate sediments. The aim was a well structured pattern of mellow bed ramps, with height differences not more than 10 – 15 cm, and following scours.

Along the river banks foot and bicycle paths have been realised. Partially, directly next to the river and in sections further away, along the dykes and reservoir slopes. Basically the human use shall be reduced to the essential dimension. Therefore no recreational institutions are planned in the retentions area and especially in areas which are deserved to be protected, the path network is further away.

One problem concerning the methodology was the absence of a descriptive method to show the complex social and ecological relations inside and between the organisms in the range, because in a construction plan it is just possible to show the surface area without content. To overcome these problems a combination of a 1:1 model, laboratory tests and traditional planning methods were developed.

# The Tumut River: An Australian Approach To Regulated River Management

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## Summary

Situated in the south-east of Australia, the Tumut River forms part of the water supply system from the Snowy Mountains Scheme. It services western New South Wales and supports agricultural industries annually worth over \$700 million. Historically the river has been regulated on an engineering basis, to maintain channel capacity with little consideration to river ecology. The main works that were undertaken were full bank height rock armouring to prevent the erosion of banks and the removal of large woody debris to improve hydrological performance.

Recent social changes in Australia have directed pressure on Governments and industries to rehabilitate and improve the degraded Australian landscape. These pressures have demanded a change to the ecological management of Australian rivers which have long been detrimentally affected by anthropological impacts.

The Tumut River is now being managed to include ecological considerations in its annual works program. A reduction in the amount of rock that is used for erosion protection works and the retention, and even the possible future reintroduction of, large woody debris are amongst some of the ecological improvements that are now considered. The implementation of revegetation programs, wetland management programs and fish habitat enhancement works are also leading towards a river that is not only hydrologically efficient but also ecologically effective.

## **The Restoration of the Channelized Sangro River (Abruzzo, Italy): Tackling the Challenge of Providing “Less Hydraulic Risk, More Environment”**

*Andrea Nardini and Ileana Schipani, members of the Technical Board of the Italian Centre for River Restoration (CIRF).*

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### **Summary**

This paper illustrates the restoration project of a stretch of the Sangro river (Abruzzo Region, Italy), strongly channelized in recent years, which involved the Italian Centre for River Restoration (CIRF) as scientific advisor.

At the beginning of the 1980s a 6 km long portion of the Sangro river was channelized in order to improve flood protection. The river bed was straightened, paved and embanked with an inner and outer concrete wall. Most of the braided river was cleared of vegetation and levelled, which gave rise to a surface without soil, over which, even nowadays, plants hardly grow.

At present the environmental degradation has become severe as a result of different factors: the morphological modifications of the river and riparian zones and the bad channel maintenance, partly destroyed by floods, have caused damages to the alluvial plain, flow dynamic and water environment. Nevertheless, the hydraulic risk has strongly increased as effect of a growing urbanization on the former floodplain.

Recently, the Abruzzo Region involved the Italian Centre for River Restoration CIRF to provide scientific support to the Sangro river restoration process, which is at the moment still in progress.

The challenge to face was to find the correct approach to achieve jointly multiple objectives such as the decrease of hydraulic risk, ecosystem rehabilitation, amenity and recreation, not to mention economic viability. By an accurate analysis of the fluvial dynamics, a river setting alternative to channelization emerged. A specific design of land use pattern, coupled with a few targeted actions, were devised in order to let the river reclaim as much as possible of its former floodplain and to introduce structural facilities that enhance its ecosystem processes. Such scheme would allow the availability of spaces devoted to flooding providing the natural inputs for the spontaneous evolution of the riverine environment.

## Joining up Flood Defence, Biodiversity and Rural Livelihoods in Washlands, in England

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### Summary

Changing priorities in rural and environmental policy, evident for example in the Reform of the European Common Agricultural Policy and the Water Framework Directive, are encouraging a re-appraisal of land management options for floodplain areas. In England and Wales, this coincides with the Government's strategic review of approaches to the management of flood risk, entitled 'Making Space for Water'.

In this context, the paper sets out to explore how managed washlands can potentially provide benefits for flood management, habitats and wildlife, and do this in ways that are appealing to land managers. Following a survey of flood managers and conservation officers to identify key issues, a method for classifying washlands according to degree of hydraulic control for flood management and potential for habitat management was constructed. Actions which can be taken to 'engineer' or manage particular flooding and soil wetness regimes for the purpose of habitat management were also identified. The method was demonstrated through 5 English case studies.

The study showed that although there is potential synergy between flooding and biodiversity under most flood regimes, biodiversity benefits mainly depend on the management of water regimes following flood events. Where farm land is involved, this will limit land use to extensive wet grassland. There is a clear need to 'join up' the many aspects of hitherto fragmented policy and funding mechanisms if integrated washlands are to be developed to their full potential. There is, however, opportunity to do this given changing policy priorities. These issues are being further explored in an ESRC funded study of integrated floodplain management under the Rural Economy and Land Use Programme.

## The River Rhine – Safety Measures Meet Ecology and Vice Versa

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### Summary

The River Rhine with its large transboundary catchment through nine countries and has a history concerning river restoration activities. The big change started after the Sandoz-accident and the launch of the Rhine Action Programme (1980). Since then, NGOs have been very active in awareness rising and involving the public to get back “living rivers”. At this time “ecological restoration” really started along the big rivers.

River rehabilitation or restoration projects in the Rhine catchment were carried out mainly by specific and active measures, only few rehabilitation projects allowed the River Rhine to reshape the flood plain in a more or less natural way. A big positive effect on the overall water quality in the Rhine was realised with the improvement of the sewage treatment in the basin, which was pushed by the International Commission for the Protection of the River Rhine (ICPDR). The water quality improvement made the Rhine water system suitable again for certain fish species, such as trout and salmon. But in the Rhine catchment with its more than 450 dams and weirs, fish migration was another big hurdle.

The interest change safety versus ecology can be clearly seen in the Netherlands. Nowadays after the big flood events from 1993 and 1995, a change in water and spatial policy took place. The further enlargement and heightening of dikes was left and instead of this, the Dutch government would prefer to give more room to the river to be safe on the longer term. The so-called “Spatial Planning Key Decision” within the national plan of “Room for the river” must deliver a flexible framework to realise adequate flood defence in the Netherlands and will be submitted to Parliament in 2006. The framework contains a basic package of in the first place measures to be taken in between the winter dikes, such as lowering the floodplains, groyne improvement, and in the second place also certain measures outside of the winter dikes, such as dike relocations and green rivers/bypasses. The basic package was selected after careful cost benefit and hydraulic analyses, taking into account the possible reduction of high water discharges in the Rhine, as well as the protection of valuable nature areas and cultural landscapes and economic development.

In the current situation ecological (restoration) measures are valued due to their reduction of flood peaks at first and often just secondly because of the specific or unique habitat that can be developed. Up to 2015, the Dutch government will spend 2.2 billion Euros maximum to implement the basic package in the Dutch riverine area. Ecological measures will mainly take place by lowering of floodplains, construction of secondary gullies along the branches of IJssel and Nederrijn, and minor along the Waal branch, which is the main navigation route from upstream to Rotterdam harbour. Two large de-poldering actions will be done in the Lower Rhine area (Noordwaard and Overdiepsche polder).

Real “ecological” restoration projects are undertaken in the so-called “Restoration and Development programme” of the Ministry. Measures are the construction of fish passages, nature friendly banks along the River Meuse, and Haringvliet sluices ajar. The involved budget for the coming 6 years programme is 175 million Euros. More ecological restoration projects are implemented mostly in the smaller river and stream catchments in the Netherlands but the same is valid for German, too. Due to change in agricultural policy in Europe, the land use change offers new possibilities in order to create dynamic and natural streams.

## Achieving Favourable Condition on the Somerset Levels and Moors

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*A Baines, Environment Agency*

*S Parker, English Nature*

*J Phillips, Defra Rural Development Service*

### Summary

The Somerset Levels and Moors represent the largest remaining area of coastal and floodplain grazing marsh in England and include outstanding wet grassland habitats that depend on appropriate water and land management practices to sustain the wildlife, cultural and economic interests and landscape value of the area. The Levels and Moors Environmentally Sensitive Area Scheme, established in 1987, led to the restoration of a number of key wet grassland sites in Somerset and helped reverse a long-term decline in wetland conservation interests caused by land drainage and agricultural intensification. However, inappropriate water level management remains one of the main reasons why some wetland SSSIs on the Levels and Moors are not achieving favourable condition status. To address these issues, the Drainage Boards in Somerset are working with English Nature, the Environment Agency and Defra RDS to review existing Water Level Management Plans (WLMP) and identify how the WLMP framework and Environmental Stewardship agreements can be co-ordinated to achieve the conservation objectives over larger areas.

Central to this work is the establishment of water level management regimes that support appropriate farming activities (especially extensive summer grazing), maintain high ground water tables and aquatic features throughout the year and provide areas of field surface water during winter. There is also a need to develop sustainable management systems that can operate at appropriate scales in order to; maximise the area that benefits, minimise the number of control structures, simplify operational and maintenance requirements and, where appropriate, enhance floodwater storage. The combination of the WLMP framework and Environmental Stewardship agreements provide good opportunities for farmers and operating authorities to resolve some of these issues and improve water level and land management practices in floodplain areas. For example, Environmental Stewardship includes a range of funding options for farmers to manage water levels for wintering wildfowl and breeding waders, and to maintain high ground water tables for plant and invertebrate communities in fields and ditches. Defra grants are also available to Drainage Boards for water level management improvement schemes that protect and enhance designated wetland sites.

This presentation will give a brief overview of water level management in Somerset and highlight how the WLMP framework is being used to identify practical management solutions and that aim to restore and maintain floodplain habitats. The Drainage Boards and partner organisations in Somerset are developing a number of water level management improvements schemes for the Levels and Moors. These will be used to illustrate how large-scale, whole moor management systems, in combination with suitable HLS agreements, can achieve favourable condition for designated sites, help restore and maintain floodplain habitats and may potentially provide additional public and environmental benefits.



## Summaries of Presentations

### SECTIONS 8A, B & C

**SCOTTISH  
NATURAL  
HERITAGE**



## Laeca Burn Diversion - Making the Best of a Bad Job!

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### Summary

Northern Ecological Services were commissioned by Stoneyhill Waste Management Limited in September 2001 to produce a Method Statement for the diversion of the Laeca Burn around the proposed extension to the landfill site at Stoneyhill, near Hatton, Aberdeenshire. The MS was to be implemented by the Company and their consultant engineers with an Ecological Clerk of Works service provided by NES.

Data collation and consultation exercises were undertaken with Cordah Limited, Scottish Natural Heritage, the Scottish Environment Protection Agency Habitat Enhancement Initiative and the River Restoration Centre.

The Laeca Burn and its floodplain support a number of semi-natural habitats (in decreasing order of local importance):

- Floodplain mire
- Swamp
- Dry dwarf shrub heath
- Unimproved acid grassland
- Unimproved neutral grassland (2 types: frequently inundated and less frequently inundated)
- Marginal vegetation
- Dense and scattered scrub

The following ecological objectives were set for the diversion of the Laeca Burn:

- Maintain the habitats of floodplain mire, swamp, dry dwarf shrub heath and unimproved acid grassland.
- Re-create and enhance the physical conditions suitable for the re-establishment of unimproved neutral grassland (both types), marginal vegetation and scrub.
- Re-create and enhance the physical conditions of the watercourse and its floodplain for aquatic and other fauna, including birds, water voles, fish and invertebrates.

This talk describes the sequence of events from the production of the Method Statement to the completion of the burn diversion two years later and the lessons learned. Although recommended, to date the author is not aware of any Post Project Appraisal being carried out.

## Experiences from a Seven-Year Programme of River Restoration Management Research: the Case of the River Cole Restoration, near Birmingham, UK.

*N J Clifford (Nottingham University), A M Gurnell (King's College, London), G E Petts (Birmingham University), O P Harmar (Halcrow) and P J Soar (JBA Consulting)*

### Summary

This paper examines the findings of an integrated programme of study relating to flow behaviour, morphological response and riparian vegetation establishment along a 400 m reach of totally new-cut river. The work was funded jointly by the Natural Environment Research Council (NERC), the Environment Agency and RMC Aggregates. The new river, in the West Midlands, was cut following the cessation of aggregate extraction, and is a potential design analogue for lowland river and floodplain re-establishment in the UK. Over a three-year period, significant morphological adjustment of the river, changes in river flow behaviour at various scales, and the occurrence and growth of both planted and naturally imported species has been observed. A typology of river bank and river profile 'naturalisation' is offered, and this typology may further be related to vegetation characteristics and change. As river morphology has changed, so too has the range and variation of depths and velocities, which index physical habitat.

Importantly, the work at this restoration scheme is placed within a wider programme of research examining the management of river channels from the standpoint of a closer coupling of river bedform and process dynamics, vegetation establishment and response, and the identification and evolution of physical habitat delimiters. The work not only presents findings at this site, but offers improved methodologies of channel environment inventory and appraisal which might be transferred between sites, and more general conclusions and conceptual models of post-restoration stream environment response.

The work is also an example of partnership between research councils and academics, the Environment Agency and industry. Two of the authors are now practising in environmental consultancy.

# Does river restoration enhance biodiversity in or flowing rivers? Evidence from Southern England

*Jeremy Biggs<sup>1</sup>, Penny Williams<sup>1</sup>, Mericia Whitfield<sup>1</sup>, Simon Bray<sup>2</sup>, Dave Sear<sup>2</sup>, Gill Fox<sup>1</sup>, Pascale Nicolet<sup>1</sup>*

<sup>1</sup>*Pond Conservation, Oxford*

<sup>2</sup>*University of Southampton*

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## Summary

A restored length of the River Cole in southern England was investigated to identify factors that influenced recolonisation of the channel and to assess the value of the restoration to local and regional biodiversity.

The restored channel supported significantly greater numbers of wetland plant and macroinvertebrates species, more species preferring faster and flowing, and a greater cover of plants and abundance of invertebrates than an upstream control site. Species rarity, however, differed little between restored and control lengths.

Analysis of biotic heterogeneity showed that assemblage dispersion was not greater in the restored than in the control reach. Thus the restored river was richer because of macro-scale changes (e.g. a shallower faster flowing, more gravelly channel) than because of greater habitat heterogeneity created within the channel. This was supported by geomorphological data which showed that although the restored channel supported a greater number of hydraulic biotopes and bedform types, both lengths were dominated by single habitats: fast flowing glides in the restored section, deep, slow flowing pools in the control.

Assessment of propagule sources showed that the restored river assemblages were dominated by species already present in the near surrounds, with most plant and invertebrate species recorded within 1km, and 98% within 5 km of the works.

Overall, these findings suggest a need for increased subtlety and complexity in the design and location of restored river channels. In particular there is a need for restoration designs to consider three dimensional bedform heterogeneity, as well as channel sinuosity. The location of restoration schemes is also important, since it is likely that the quality of the surrounding area will be critical in determining the quality of the restoration reach.

# Environmentally Sensitive Intervention vs Engineering Risk - The Conflict Can be Resolved

*Hugh Ellis B.Sc Botany (Hons)*  
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## Summary

River training works and erosion control systems have developed rapidly in the last decade. Historically, hard armour solutions were prevalent as they provided the designer and client with confidence that the solution would be robust and durable. There was little consideration for the environmental impact and aesthetics of the solution.

This paper presents a range of solutions that can vegetate and re-establish habitats as well as offering the durability and sustainability required.

There are river training works in a wide variety of site and conditions around the world constructed over the last 125 years, and within the UK since the 1960s. Current bank protection techniques take account of the fact that rivers are physically dynamic and are part of an ecosystem. The range of materials that are now available have greatly extended the scope for a reliable and appropriate solution for specific sites.

By illustrating a range of interventions, we will show designers and river professionals that there is a graded and logical range of erosion protection techniques. Examples will demonstrate solutions for “low “, “medium“ and “ high” flow energy situations.

Low energy situations typically rely upon plants alone to provide a soil bio-engineering solution, where the associated risk is low. Where required, short- term biodegradable materials will aid establishment. E.g. Project at Royal Bank of Scotland Headquarters, Edinburgh.

Medium energy situations use plants as an integral part of the erosion protection technique. Their resistance to erosion is enhanced by synthetic geomats which improve the root anchorage. Plants are now significant in the solution where they might historically have been eliminated in favour of a harder, ‘reliable’ solution. The ‘vegetation reinforcing geomat’ permits an engineering evaluation to assess its suitability for the application. E.g. Projects at Highland Spring Water, Blackford, and Stoneyhill Landfill Site , Peterhead .

High energy situations need robust revetments that can be evaluated and indemnified by the project designer. These systems can include vegetation which is accommodated at the design stage. Planting is incorporated during construction, accelerating the colonisation of plants within the engineered system. This saves years of low ecological value when natural colonisation is relied upon. E.g. Projects at River Gryffe, Glasgow and Saucel Street, Paisley.

All project examples demonstrate the environmental and landscape value as well as being located within Scotland to reflect the Conference location.

Tools for the design of channels will also be introduced, allowing the user to compare the performance characteristics of most erosion control methods and systems including; mats, grasses, wattles, brush-layering, gabions and live staking. The ability to assess environmental value with how these solutions perform technically within the required channel conditions, will open more opportunities for softer solutions to be adopted.

## Ecologically Designed Intertidal Flood Defences in a Key Area of Urban Regeneration: Multiple Benefits and Lessons Learned

Mike Wells MIEEM MCIWEM MIBiol CEnv CBiol CSci (Biodiversity by Design Ltd) & Steve Colclough MIFM CEnv (Marine Fisheries Policy Advisor, Environment Agency, Abbey Wood)

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### Summary

The tidal Thames ecosystem reached a nadir in the 1950s due to a long history of pollution. Installation of treatment works and the demise of the more polluting industries have been correlated with a dramatic improvement in water quality and riverine life. Further recovery is now being retarded partly by occasional storm sewer overflows in severe weather, but primarily by a lack of the marginal habitat needed by many species. As part of the strategic regeneration project for the Greenwich Peninsula, east London, in excess of a kilometre of sheet-piled river wall along the tidal Thames was replaced by intertidal terracing, thereby giving land 'back' to the river. The project was undertaken as collaboration between English Partnerships and their consultants and the Environment Agency. Construction and planting took place in 1998 and 1999. Some terraces were planted or partially planted, others were allowed to colonise naturally. Monitoring has provided several useful insights:

- Initial concerns about the loss or erosion of substrates installed in the terraces were unfounded, the substrates naturally sorting into 'beaches' of quite natural appearance. Protection matting was probably unnecessary and initially damaging. The visual aesthetics of the vegetated terraces have received compliments from a wide variety of commentators.
- The botanical design of the planted terraces included large regular stands of different species, but the Common Reed *Phragmites australis* has become overwhelmingly dominant in most places. Natural colonisation, initially by Sea Aster *Aster tripolium*, was apparent within months of construction. Sea Aster was found to thrive at all tidal levels, including along riverside and seawall edges of the Common Reed stands. Planted Sea Club-rush *Bolboschoenus maritimus* increased by around 100% in absence of Common Reed. Cover of other planted species has declined.
- Litter trapping has proven to be a relatively minor and periodic problem that has developed as the terrace vegetation has matured, trapping litter behind tall reed stands.
- The invertebrate populations of the terraces are more diverse than those which had existed previously in the foreshore on and adjacent to sheet piling and fendering. Principal species that appear to have benefited in terms of numbers are the Dun Sentinal Snail *Assiminea grayana*, oligochaetes and insect larvae.
- Terrace construction has created new nursery areas for fish fry notably for Sea Bass *Dicentrarchus labrax* and Dace *Leuciscus leuciscus*. Fish diversity and density have increased since construction. Observations of flat-fish behaviour provide grounds for modifying the design of such terraces in future.
- A total area of 0.25 ha of reed bed now established in the planted terraces has supported at least two pairs of Reed Warblers *Emberiza schoeniculus* and a pair of Sedge Warblers *Acrocephalus schoenobaenus*, much as predicted. Large flocks of bird species (a potential concern to civil aviation) have not been observed.
- The current developers of the peninsula, Meridian Delta Ltd (a company formed by Lendlease and Quintain), are funding and promoting ongoing ecological monitoring and its use in improving ecological design around the peninsula.

# Goosemoor Regulated Tidal Exchange Project, Exe Estuary

Jane Brookhouse, RSPB Area Reserve Manager  
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## Summary

Intertidal habitats are disappearing at an alarming rate, as a result of climate change and sea level rise. Managed realignment is an accepted technique for offsetting some of the habitat losses; however, opportunities for such realignment are unlikely to replace the predicted area of loss. A less well-known technique is **Regulated Tidal Exchange (RTE)**, the controlled exchange of seawater to an area behind fixed sea defences, through an engineered structure. The RSPB identified an opportunity at Goosemoor, a 6ha under-performing part of the Society's Exe Estuary reserve adjacent to the River Clyst, to trial this technique using a self-regulating tide-gate. The objectives for the Goosemoor project are to: demonstrate the potential uses of the RTE technique, including for flood defence/management benefits and the creation/restoration of intertidal habitat; to improve the biodiversity of a potentially important part of the Exe Estuary; and to develop the project in partnership with the Environment Agency, English Nature, Defra, (all of which gave financial support) and other coastal decision makers.

Contractors were on site for approximately 2 months during the late summer of 2004, reprofiling ground levels, installing a large pipe through the seawall, and attaching the tide-gate (imported from the US, as they are not yet manufactured in the UK). The work progressed extremely well and was completed by the end of October 2004. Early engineering advice for such a project is essential, and liaison with partners has been extensive throughout.

A comprehensive monitoring programme has been undertaken during the first year, and some good results obtained. The attachment of data loggers to the tidegate has monitored both internal and external water levels, providing some interesting, if complex, results. Monitoring of accretion levels has shown a mean accretion rate of  $29 \pm 5$ mm, the highest accretion rate being on the lower ground. The botanical monitoring, undertaken by point quadrats, has revealed colonisation by a range of saltmarsh species, including the rare stiff saltmarsh grass (*Puccinellia rupestris*), and the sediments have also shown colonisation by species of benthic fauna, and all three main prey species, *Corophium*, *Nereis*, and Chironomids were discovered in low numbers. Although no birds bred on the site last spring (2005), regular counts have indicated that the number of passage and wintering waterfowl using the site for feeding and roosting has increased dramatically, along with the variety of species. At the time of writing, peak winter counts have included the following: wigeon (320), teal (125), Brent goose (348), black tailed godwit (250), lapwing (620) and curlew (207).

There is further monitoring to do, and it seems that further adjustments may be required to fine-tune the internal water levels in order to enable further habitat development. However, in just in one year, the site has demonstrated a significant shift from a freshwater system to a brackish one. RTE may be a short- to medium-term measure, as it relies on the maintenance of flood banks, which is often likely to be unsustainable in the long term. The technique may prove a good way of preparing land behind defences for subsequent realignment. Whatever the circumstances, it is hoped that the Goosemoor site will provide a valuable demonstration of what the Regulated Tidal Exchange technique can deliver.

## **River Restoration in Ireland – Our Experiences over Two Decades.**

*M. F. O’Grady, Central Fisheries Board, Dublin, Republic of Ireland.*

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### **Summary**

This presentation provides a chronology of land management practices in Ireland and outlines how many such individual programmes have impacted on salmonid stocks. The methodologies used in relation to quantifying change are detailed. Systems developed to enhance damaged salmonid riverine habitat are outlined. Examples of the relative degree of success of individual enhancement programmes in different salmonid habitat types are provided. Some of the key features outlined in a recent Central Fisheries Board publication on stream enhancement procedure (Channels and Challenges) are highlighted.

## Restoring Habitat and Biodiversity on the Ballinderry River, Co. Tyrone

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### Summary

The Upper Ballinderry River is designated as an Area of Special Scientific Interest (ASSI) and Special Area of Conservation (SAC), as it supports one of only three viable populations of Freshwater Pearl Mussel (*M. margaritifera*) in Northern Ireland, along with European otter (*L. lutra*) and water crow-foot habitat (*Ranunculus*).

Ballinderry Fish Hatchery Ltd is a community business, established by the Ballinderry River Enhancement Association (BREA). The association is made up of seven angling clubs who share a common vision for the river - to restore the Ballinderry River to its former greatness.

Since its establishment, Ballinderry Fish Hatchery Ltd has developed innovative methods to enhance and restore fisheries habitat, improving the spawning and rearing potential in rivers across the province and increasing freshwater biodiversity. Through restorative breeding programmes, in conjunction with improved and restored habitat, the hatchery has seen an increase in numbers of native Ballinderry Brown trout, Dollaghan trout and Atlantic salmon over the last twenty years. The hatchery has now embarked on a new project, rearing salmon in a lake, before release as smolts to the river.

In partnership with WWF Northern Ireland, with additional funding from Environment and Heritage Service, Ballinderry Fish Hatchery Ltd is working with riparian landowners to address the issue of pollution and deteriorating water quality, evident in many UK Rivers. The project aims to demonstrate how sensitive land management, education and cooperation can reduce the pressures placed on freshwater.

In 1997 the hatchery, in conjunction with Queens University Belfast, pioneered an experimental Freshwater Pearl Mussel breeding programme in an attempt to boost the struggling population in the Ballinderry River. The breeding programme has been the only successful project in the UK to date and is currently providing valuable information to other similar breeding programmes across Europe.

Through these and many other projects, the hatchery continues to improve water quality, restore habitat and create sustainable species populations in an attempt to safeguard the future of the Ballinderry River.

## Fish passage restoration by means of nature-like constructions - ecological requirements versus construction stability

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### Summary

Many rivers all over the world have seen severe anthropogenic modifications due to various water utilizations. Numerous dams, weirs, hydropower plants and locks interrupt the continuity of rivers and their tributaries and therewith delay, hinder or block migrations and other movements of fish. As fish populations are highly dependent upon the characteristics of their habitat, for example for reproduction, juvenile production and growth, up- and downstream fish passage has to be provided at these water management structures in order to mitigate their impacts.

An assessment of migration barriers within the 4,485 km<sup>2</sup> large catchment of the Ruhr River Basin revealed that out of altogether approx. 1,300 almost 300 water management structures, such as old irrigation weirs or mills, are no longer in use. River restoration concepts that have been implemented in recent years for river reaches or even entire tributaries and sub-basins focus on their complete or at least partial removal. Weir removals however fairly often require river bed protections in those cases where for example river regulations or bottom elevations were previously undertaken and where future bed erosion has to be prevented. Nature-like rock ramps that are specially designed to facilitate passage of aquatic organisms are then usually constructed. In those cases where structures may not be decommissioned, river continuity can be restored by means of nature-like fish passes such as stream-like bypasses or pool-type channels.

Nowadays in Germany, Austria and Switzerland nature-like constructions represent the preferred building type in all restoration measures wherever their realization is feasible. Their design philosophies are ecologically minded, aiming to achieve a good fit with the specific riverine environment as well as the landscape they are constructed in. State Water Authorities usually promote their installation and provide financial support where ever river restoration concepts exist.

Specific design guidelines and recommendations are available in some States, but they tend to either only deal with fish passage aspects or solutions for flood stable constructions. Only rarely are both issues addressed in one publication.

The presentation will give an overview of the various types of nature-like fish passes. It will focus on the different designs, dimension recommendations, building methods and materials, structural & hydraulic stability (flood stability) as well as costs.



## SUMMARIES OF POSTERS



## **Experience in Development of an Integrated Ecological/Engineering Project for Small River Basin Management in the South of Russia Steppe Zone**

*A. Y. Kosolapov, Prof. V. N. Shkura, North-Caucasian Branch of the Russian Research Institute for Integrated Water Management and Protection, Novocherkassk, Rostov Oblast, Russia*

### **Summary**

Small rivers of the Lower Don basin (steppe zone of the South of Russia) experience high anthropogenic load caused by intense economic activities on the catchment territory and the rivers use for water supply, irrigation and water disposal. The river runoff intense use and modification of natural landscapes have led to changes in natural proportion of river catchment water balance elements, and, consequently, to river hydrological regime disturbances.

The region small rivers are characterized by high degree of the runoff regulation. The total value of small river water resources change resulted from the runoff regulation with ponds and reservoirs can vary from the annual runoff several per cent to several tens of per cent.. Given low flowage of the ponds, this leads to salinity accumulation and eutrophication of water bodies. Many ponds have significant dissipation losses due to unfavorable hydrogeological conditions and low-quality filling of the dam body as well as the absence of necessary anti-filtration facilities.

Irrigated farming is a considerable factor of small river resources depletion in the steppe zone of the south of Russia.. Farming on the catchment territory and along the river banks has led to changes in bottom sediments in connection with intense silting; absorption of solar radiation has increased; water temperature has increased and the oxygen balance has been disturbed. Besides, within-year river runoff distribution changes, especially when irrigating crops, and riparian vegetation is damaged. Additional evaporation from irrigated fields in the river basins amounts tens per cent of its natural value. Besides, within-year river runoff distribution changes, especially when irrigating crops, and riparian vegetation is damaged. Sediment load increase and silting rate significantly influence water quality. They negatively affect rivers causing changes of spawning terms and fish behavior in spawning season or causing loss of spawn due to suffocation.

The catchment surface changes caused by farming resulted in maximal flood flow increases and more often and prolonged low-water periods. As a result of withdrawal-consumptive water use for industrial and farming purposes the small river runoff in the basin has decreased by 10-30%. The above listed problems are typical for the majority of small rivers of the steppe zone of the South of Russia.

The submitted paper represents a pilot project in respect of the Kundruchya River (a second order tributary of the Don River), a typical enough river for the Southern Russia steppe zone. The project was aimed at development and implementation of measures on ecological upgrading of the basin water bodies, restoration of fluvial anadromous and diadromous fish species reproduction conditions, mitigation of risks of waters negative impact on the population and economic entities.

In the framework of the project integrated investigation of the river basin natural/engineering system has been carried out: analysis of the natural environment parameters, features of the

river runoff formation, the river hydrological regime, the runoff parameters and within-year distribution, and the sediments runoff; sites of high anthropogenic impact; the river bed and floodplain carrying capacity, sites of possible ice jams and blocks, the zones of maximal floodplain flooding; an inventory of water intakes and waste water discharge points, schemes of their location; current water/economic balance of the basin; main sources of pollution and their impact upon water quality formation; an inventory of water works, a list of potentially dangerous water works that need repair; proposals concerning liquidation of currently useless water works; assessment of the spawning sites current condition and their suitability for natural reproduction of fluvial anadromous and diadromous fish species.

## How the Traditional Floodplain Economy Could Help Plan Restoration Works?

Attila Nagy<sup>1</sup> – Denes Loczy<sup>2</sup>

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<sup>1</sup> Senior Lecturer. University of Pecs, Faculty of Sciences, Institute of Geography.

### Summary

In South Hungary there are wide floodplains along the Danube. These are conservation areas now, part of the Danube-Drava National Park. The river regulation measures executed in the 18<sup>th</sup> and 19<sup>th</sup> century hinder floodplains in fulfilling their various ecological functions nowadays. The dykes are located too close to the channel and restrict the floodplain, thus the river accumulates in them. Due to the increased flow velocity at low water the river incises into its bed, so it drains the surrounding groundwater. The extreme changes of the groundwater level deteriorate the ecological conditions. The abandoned channels cannot ensure a satisfactory water supply, either.

Floodplain restoration works started in the 1990's to provide better ecological conditions, preserve wetland habitats and to maintain traditions. But in planning processes we should go back and study the past at first, how people adapted to the natural changes of water level.

In medieval times a traditional floodplain economy existed and there are still remnants of the ditch (in Hungarian "fok") system that served this land use type. People who lived along the Danube allowed the floodplain to be inundated during floods and the water to flow back at lower water level.

The *foks'* characteristics are as follows. They cut through the levee at the lowest point of the ditch. Their mouths are connected to the riverbed against flows direction, so the water filled up the channel slowly (without causing destruction) and deposited less load. Usually these channels connected the riverbed to oxbow lakes, which were used as fish ponds. The outflowing water allowed additional kinds of land use forms, like orchards, vineyards and pasture.

My geomorphologic research is meant to support the floodplain restoration plans. In these processes the first step is an exploratory work to investigate how the surface of the floodplain has developed over the past millennia. My aim is to reconstruct the evolution of landforms with the help of archive maps and digital elevation models. I have prepared a DEM for the present state of the area and studied the human impact on landforms. In addition I study particle size distribution of collected samples from the region to explore natural and man-made ditches, human activities in the past. Investigations of groundwater flow in the area provide us another point of view how the hydroecological problems arise and could be solved. These studies help us understand past land use of floodplains and guide us a how to better adapt for natural conditions today.

## **An Urban River Restoration Strategy for North London**

*Matt Carter and Judy England*  
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*judy.england@environment-agency.gov.uk*

### **Summary**

For millennia rivers have been integral to connecting people with their environment, but in London, as with many modern cities, these connections have been lost. River restoration is therefore a key process that can help re-establish these broken links between people and wildlife, thereby making it an important part of the wider challenge of urban regeneration.

A healthy environment is known to improve people's quality of life and rivers and their floodplains are recognised as being a key element to maintaining a healthy environment; as such this strategy forms one of many important initiatives currently being promoted across London.

The restoration strategy for London is presented in two documents; the South London Strategy produced in 2002 and the new North London Strategy published in 2006. The North London strategy describes the actual process of 'how' to plan river restoration and illustrates with examples the variety and scales of projects that have been undertaken across London, and identifies new areas of opportunity using colour coded maps. In addition, other useful information such as links to potential partners and funding opportunities is also provided.

Together these strategies form a London wide approach to urban river restoration. They promote and advocate the overriding principle of working in partnership to seek opportunities in line with other plans and strategies, to deliver outcomes that maximise social, economic and environmental benefits, through restoring and re-connecting rivers to wildlife and people.

These documents set out the Agency's vision for the future and place it in context with other major strategies currently taking place across London.

## **Developing a Long-Term Vision for Urban River Restoration; Feedback from a River Restoration Conference Workshop, 2005.**

*Matt Carter and Richard Tyner  
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### **Summary**

Urban regeneration by social and economic investment is a current and high-priority agenda for many Nations across Europe, and indeed the world. An integral part of any urban regeneration is the re-connection of people with their environment, typically through the development of existing open spaces. Rivers strongly characterise urban centres, once being the reason for many early settlements, and remain a focus for people and life-line for wildlife between open spaces. The restoration of degraded, urbanised rivers must therefore be an integral part of urban regeneration, bringing with it social, economic and environmental benefits.

The concept of urban river restoration is not a new one however tends to be localised, yet cities across Nations clearly share similar challenges and goals. An international network for practitioners is still relatively under-developed, as are collective thoughts and objectives. The 2005 River Restoration Conference hosted in North London provided an ideal opportunity to gather ideas from a range of people having varying interests and experiences of urban river restoration. The theme for the workshop was to explore and develop a vision for urban river restoration, something that can be applied as a guiding principle for politicians, planners and developers to use as an integral part of urban regeneration.

The poster provides feedback from this workshop, summarising the ranges of views and ideas expressed, and finally the vision that seemed to encapsulate the consensus.

## **Ecological Post Project Appraisal – Application of Meso-Habitat Monitoring**

*Judy England*

*Environment Agency, Thames Region.*

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### **Summary**

Classification and mapping of meso-scale or functional habitats can be used to record the extent and pattern of distinct within-river habitats and surveyed for their associated macro-invertebrates. Using this methodology it is possible to monitor the habitat changes within a river resulting from restoration work.

The River Rib in Hertfordshire has been subject to restoration work – returning an over wide and over deep channel to one of more natural proportions. The work included creation of marginal shelves and the introduction of gravel and was monitored extensively as part of a wider project.

Meso-habitat composition was assessed before and after restoration and replicate samples of macro-invertebrate collected from each habitat. The results of this work are presented within this poster together with recommendations of how this methodology may be used in the future.

# The Eurasian Beaver (*Castor fiber* L.) in Scotland – Ecological Engineering for free?

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## Summary

The Eurasian Beaver (*Castor fiber* L.) was a common sight along British watercourses until the 1600s, when hunting and habitat loss finally extirpated the species from these shores, and indeed throughout the majority of their natural range. Over recent decades several successful reintroductions of the species have been conducted throughout Europe, but a proposed trial reintroduction of beavers to Knapdale in western Scotland was recently rejected by the Scottish Executive. In the absence of a wild population, several captive animals have been monitored over 3 years on a privately owned estate in Perthshire. This paper will present the major findings of this study to investigate the extent and nature of the ecological impacts of these “ecosystem engineers” on the stream and riparian environment. Particular focus will fall on the riparian tree felling activities of beavers, and also on the effects of the woody structures created within ponds and streams by this keystone species. These data will provide scientific answers to some contentious issues that currently surround a potential future reintroduction of beavers to the British countryside.

# The Aquatic Bryophytes from Madeira Island. Preliminary results.

Leena Luís<sup>1</sup>, Manuela Sim-Sim<sup>2</sup> and Rui Figueira<sup>3</sup>

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## Summary

The Madeira Archipelago is situated in the Atlantic Ocean, included in the biogeographic region commonly known as Macaronesia.

As a consequence of its volcanic origin, the relief of the Madeira Island is very irregular, sculpted by numerous watercourses, most of which are originated in the Laurel Forest (a World Natural Heritage by UNESCO), emphasizing the importance of this forest in the island's hydrological cycle. As a result of the geographic orientation and the vegetation cover of the island, there is a considerable differential availability of water between the north slopes (higher) and the south slopes (deficient). Furthermore, the hydric resources of Madeira are subjected to many stresses. These mainly result from increases in water demand and degradation agents, mostly resulting from human activities such as urban development, increasing tourism and agriculture. Consequently, the management of the water resources is one of the main concerns of the environmental policy implemented by the regional government, which has developed a water regional plan (PRAM), following the guidelines from the Water Framework Directive (WFD).

The WFD stresses the importance of developing ecological monitoring systems in superficial waters based on biological elements. However, there is a general lack of knowledge about the community composition and structure of aquatic fauna and flora in Madeira. Among the aquatic flora, the bryophytes have a particularly relevant ecological role, namely in watercourse stabilization, preventing floods, erosion, and fragmentation of the margins. Furthermore, as a result of their differential sensitivity to distinct environmental conditions, they can be used as bioindicators of changes in the ecosystems.

The present study investigated bryophyte biodiversity, and ecology in 15 streams, of the Madeira Island. Results concerning aquatic bryophyte diversity, and its relations to the study areas characteristics, such as involving ripicole vascular vegetation, substrate type, water chemistry, and the human pressure, are presented.

Results showed that the pleurocarpous mosses *Platyhypnidium riparioides*, *Amblystegium riparium* and *A. fluviatile*, together with *Fissidens* taxa, were the most frequent taxa in the majority of the studied areas. Rare or endemic taxa were found in areas with particular environmental conditions, highlighting the need to implement monitoring programs. In addition, in the most disturbed areas no aquatic taxa were found, mainly due to interference on the margins' geomorphology, and water pollution. In this case, restoration measures should be considered in order to attain good ecological status, as stated in the Water Framework Directive.

# The Physical Restoration of SSSI Rivers in England

*Chris Mainstone, Senior Freshwater Ecologist, English Nature*

## Summary

The designated river network offers an excellent opportunity to demonstrate strategic river restoration in action across the full range of river types in England, exploiting the additional and early obligations for action on Sites of Special Scientific Interest (SSSIs) and European Special Areas of Conservation (SACs). This poster explains how English Nature is working to generate strategic physical restoration plans for designated rivers across England.

There are some 30 riverine SSSIs in England, mainly designated as representative examples of the river habitat types present. The UK Government has a Public Sector Agreement (PSA) target to bring 95% of SSSI area in England into 'favourable condition' by 2010. Around half of these SSSI rivers are designated as SACs under the European 'Habitats' Directive. The European Commission (EC) requires that the integrity of SACs is secured as part of achieving 'Favourable Conservation Status' for habitats and species designated under the Habitats Directive. The EC has an expectation that appropriate management of SACs will be put in place by 2010 at the latest.

As part of securing the favourable condition of these sites, English Nature is embarking on a programme of developing strategic physical restoration plans. Each plan will:

- include all physical management measures required to reach a physical state consistent with favourable condition;
- be a bidding document to secure the necessary resources;
- provide a strategic framework for directing opportunistic resources and third party effort;
- probably include significant actions beyond 2010.

The aim is to have such plans in place and in the process of implementation for all physically impacted riverine SSSIs by 2010. This would confer a condition of 'unfavourable recovering' on these sites, which would count towards achievement of the SSSI PSA target and constitute appropriate physical management in the context of SACs.

Guidelines for the planning process have been drafted in collaboration with the Environment Agency. Pilot projects have been established on two rivers: the Wensum in Norfolk and the Beult in Kent. A generic rationale for SSSI river restoration is being prepared, including type-specific narratives on characteristic geomorphology, links between geomorphological processes/features and characteristic biota, and key restoration issues. Generic guidelines for undertaking fluvial audit to support the development of SSSI restoration plans are being prepared.

## LIFE-Nature project

### “Restoration of the Wetland and Riparian Area at the Upper Drau River”

*Dipl.-Ing. Klaus Michor, REVITAL ecoconsult  
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#### Summary

The Natura 2000 area "Upper Drau" is situated along the river Drau between the villages Oberdrauburg and Spittal (Austria). It contains a 68 km long section of an alpine river in the Graylingfish-region. The total area including the surrounding riparian areas amounts to 976 hectares. The river Drau has been regulated through protection structures up until the 80ies of the twentieth century. In the 1990ies the governmental department for water management in Spittal commissioned a river care scheme. Consequently the first measures to extend the river bed have been implemented by removing regulating structures. As part of the LIFE-Nature project "Restoration of the wetland and riparian area at the Upper Drau river" those efforts have been pursued. So there was a focus on removing protection structures from the river banks in order to spaciously extend the river bed. Furthermore, the project consisted of initial plantings of additional floodplain forests, establishment of new water bodies in the floodplains, reintroduction of highly endangered or disappeared plant and animal species, as well as various other protective measures for endangered species. All management measures have been implemented within the borders of the Natura 2000 area (prospective European nature conservancy). After a period of four years the LIFE Nature project "Restoration of the wetland and riparian area at the Upper Drau river" terminated at Dec 31st, 2003. By investing about 6,3 million Euro (including 26% funding from the LIFE-Nature program by the European Union) the project co-ordinators could bring the goals defined for the Natura 2000 area (species and habitat protection) into accordance with water management interests, such as stabilizing the river bed of the Drau through promoting ecologically sustainable types of water management. The tables below present the management actions and the promoted species and habitats according to the Habitats Directive.

#### Overview management measures

Management measure	extent
purchase of land for establishment of new habitats	55 ha
removing river regulation and extending the river bed	approx. 10 km of river bank
restructuring tributary streams	approx. 2 km
removal of migration barriers in streams	12 river sections
establishment of new water bodies in the floodplains	22 water bodies, area approx. 4 ha
establishment of additional floodplain forests (combine)	3000 plants, area approx. 4,5 ha
reimbursement of grazing rights in floodplain forests	65 ha
contracts covering land use of floodplain forests	approx. 4,5 ha
re-introduction of the German Tamarisk	initial planting (5 sites)
re-introduction of the Lesser Bulrush	initial planting (3 sites)
re-introduction of the Ukrainian Lamprey	stocking (approx. 500 individuals)
re-introduction of the Spined Loach	stocking (approx. 500 individuals)
promotion of the Common Tree frog	stocking (approx. 500 individuals)
promotion of the White-clawed Crayfish	stocking (approx. 700 individuals)
promotion of the Bitterling	stocking (approx. 1000 indiv.)
promotion of the Pond mussels	stocking (approx. 200 individuals)
provision of nesting sites for bats	installation of 63 nesting boxes
provision of nesting sites for the Kingfisher	Installation of 6 steep river edges/nesting sites
promotion of other fish species	Minnow, Stone Loach, Nase, Huchen and Grayling

# Vegetation Colonisation in Riparian Zones: A Context for the Sustainable Management of Riverbanks'

*Helen Moggridge, Department of Geography, Kings College London  
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## Summary

The natural colonisation of vegetation communities on riverbanks is pivotal to the success of river restoration schemes. Despite its importance, there is currently an inadequate knowledge of vegetation dispersal and establishment in riverine systems. This paper addresses this research gap using the findings of a twelve-month study exploring the transport, deposition and recruitment of vegetative propagules along the River Frome, Dorset.

Propagule dynamics were investigated in a comparable manner to a mineral sediment budget and analogous results were established, highlighting the fundamental importance of hydrochory for dispersal and deposition onto a suitable habitat. Research outcomes are presented in relation to six-weekly sampling periods, which show a clear seasonal variation in the linkage between seed production, transport and deposition. This illustrates the dependence of riparian vegetation on flood-pulsing, specifically in the timing and magnitude of high flows for the colonisation of new patches.

The findings of this study have a strong application to the sustainable management of riverbanks. Understanding the dynamics of propagule transport and establishment in particular environments enables river managers to create the suitable conditions for selective deposition and recruitment to maximise natural regeneration of riparian communities and promote biodiversity.

## **Strategic Partnerships in River Corridors - The SPARC Project**

(SPARC is funded by the European Regional Development Fund - Interreg North Sea Region Programme.)

*Tim Pickering – Project Manager*

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### **Summary**

#### **Introduction**

Nowadays, many river basins within the North Sea Region face lots of problems that affect their natural processes. Among these the most significant are declining biodiversity and loss of historic landscape character, which result from previous inappropriate water management policies and flood plain development as well as from the increasing demands of agriculture.

#### **Aims**

There are two main objectives of the project. On the one hand, it aims to increase co-operation between all interested parties in the management of river corridors, i.e. to identify appropriate bodies and individuals undertaking the work, elaborate mechanisms for them to meet, reach consensus, and exercise control over the development of their river corridors. On the other hand, the aim is to demonstrate, in a practical way, how to apply an integrated management strategy through a series of projects in each of the partner-led areas.

#### **Outcomes**

Apart from the strengthened common approach to the protection of natural processes within the river basins covered by the project, (e.g. the Ganer River Basin Denmark, River Trent UK, Wietze Stream in Germany or Gunnared district in Sweden), there is a lot of expected outcomes resulting from the integrated management. According to estimates, the minimum area of land undergoing beneficial change as a consequence of project implementation is 250 Ha. Moreover, it is expected that more than 10 km of river will be restored and about 25 water-sampling points will be showing improved quality. Conditions will be improved for re-introduction of rare breeding species, while more people are expected to enjoy their surroundings because of the more appealing recreational opportunities.

#### **Activities**

The overarching project work focuses on setting up mechanisms for establishing local partnerships and engaging communities in the development of rivers and their corridors. The partners believe, through developing different methodologies, integrated solutions will be found. In this process, the conservation of natural resources is also integrated with scientific research.

Yet another important strand of the work is dedicated to monitoring the environmental impacts of the implemented measures. In practice, partners have witnessed that the impact of regeneration work carried out is not properly assessed. Monitoring the change of environmental parameters, they will argue, can provide important concrete information on the success of the measures applied.

All of the partners will undertake concrete pilot projects. That is why a wide range of activities, e.g. restoration, preservation of river corridor environments, re-establishment of natural processes and sustainable land management practices are embedded into each pilot.

## Natural Heritage Trends: Freshwater River Restoration Projects Trend Note

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### Summary

The project details trends in freshwater river restoration projects between the years 2002 and 2005. The data used to produce the trend note has been compiled from the River Restoration Centre's database of river restoration projects in the UK.

The trends evaluated include:

- Comparisons between the primary drivers of river restoration projects such as fisheries, habitat enhancement and flood defence.
- Proportion of river restoration projects that are within rural or urban areas.
- The status of projects between 2002 and 2005, i.e. number of projects completed, proposed or cancelled.
- An overview of the number of projects in different localities across Scotland.

Accepting the limitations of the dataset the note concludes that the overall trend is one of increasing management of freshwater bodies and catchments.

## **Ecological River Restoration: Combining Ecology and Engineering**

### **Development of the informational/reference database “River restoration ecological integrated methods and projects”**

*Prof. N. Prokhorova, I. Shalyapina*  
*RosNIIVKH*  
*Yekaterinburg, Russia*

#### **Summary**

Informational/reference database “River restoration ecological integrated methods and projects” includes the base of methodological (calculated) materials, projects including graphic material, description of techniques, legal acts, and equipment used in water body restoration.

As a six-year long participant of the European Center for River Restoration (ECRR) activities RosNIIVKh has accumulated considerable knowledge on this issue, it has an experience of integrated works connected with small river restoration, regulation of carrying capacity of riverbeds, restoration of runoff characteristics as well as morphometric and qualitative indicators.

Classification of water protective and water/economic measures for small rivers with specific kinds of human impact and various geographic conditions was taken as a ground for the database. This base is intended for practical application in planning of prophylaxis measures on water bodies and accident prevention as well as for restoration of water bodies disturbed with anthropogenic impacts.

# Impacts of Floodplain Restoration in Nitrogen Fluxes (Restored River Cole)

*Fotis Sgouridis, Department of Geography, Queen Mary University of London, Mile End Road, E1 4NS London, email: f.sgouridis@qmul.ac.uk*

## Summary

Many river-floodplain ecosystems have been altered throughout centuries by human intervention through agricultural intensification, urbanisation of floodplains and channelisation of streams and rivers. Engineering works for flood defence and land drainage have compromised the natural functioning of river-floodplain ecosystems. As a result, extensive marginal wetlands and buffer zones have been lost and riverine biodiversity has decreased. Moreover, a marked reduction in the capacity of floodplains to retain water and alleviate flood impacts has been observed. Additionally the nutrient retention capacity of rivers and adjacent floodplains has decreased considerably.

However, during the last couple of decades there has been an increasing awareness of the value of river and floodplain restoration for integrated catchment management. EU legislation influences such as the Water Framework Directive and also the Ecosystem Approach suggest a more holistic strategy to tackle ecosystem regeneration and human needs at the same time. Floodplain restoration projects are becoming increasingly popular and attract funding from various sources as different aspects of the regeneration are still inadequately investigated.

The selected study site is the River Cole, a 2 km reach with a rural clay-based catchment of 129 km<sup>2</sup> with good water quality. This stretch of the River Cole was restored almost ten years ago as part of a joint Danish and British *EU-LIFE* demonstration project. The main aim of the restoration project was to partly recreate the old River Cole course by restructuring meanders, raising the bed and narrowing the river to create a more natural flow and inducing at the same time more frequent overbank flooding to increase the river-floodplain connectivity. Special attention was put to create more diverse riverine habitats that would benefit biodiversity and more natural functioning.

Ten years later, we are interested to see whether the increased river-floodplain interaction has affected nutrient cycling, and especially nitrogen and carbon cycles, and to quantify this change. We will be looking at the denitrification potential of the frequently inundated floodplain soils and also the actual denitrification rates using <sup>15</sup>NO<sub>3</sub> labelled experiments with the aim to identify denitrification hotspots. Moreover, the potential for autotrophic denitrification will also be investigated, since this process can become very important in reducing NO<sub>3</sub>-N, where there are high concentrations of Fe. The potential for production of CH<sub>4</sub> and N<sub>2</sub>O from inundated floodplain soils will also be explored and quantified, since these are important green-house gases that can play a role in regulating climate change. However, the above processes are largely driven and controlled by the specific hydrological conditions that prevail at the catchment. The hydrological characteristics of the study site will be thoroughly studied with the aim to determine how the change of hydrological connectivity from pre-restoration to post-restoration has affected the different nitrogen retention processes. Finally, the last question to be addressed will be whether the increased river-floodplain interaction has benefited in-stream water quality especially in the case of floodplains reclaimed from arable fields with a long history of fertiliser and pesticide application.

# A Geomorphological and Hydrological Strategy for the Conservation of Freshwater Pearl Mussel in the River Kerry

Thomas, R., and Hoey, T.B.

Department of Geographical and Earth Sciences, University of Glasgow

## Summary

The River Kerry is a 5km long, fast-flowing river near Gairloch in Wester Ross, and is in many ways typical of the mixed bedrock-alluvial rivers of the north-west Highlands. The flow regime of the Kerry is considered to be highly modified due to the presence of a hydroelectric dam in the upper reaches and a salmon hatchery at the mouth. The lowermost 3.4km has been designated as a Special Area of Conservation (SAC) under the European Union Habitats Directive as these reaches represent one of the best stretches of river in the UK for the endangered freshwater pearl mussel *Margaritifera margaritifera*. The mussel population in this area is significant not only in terms of its size, but also as a result of the favourable age-structure. Scotland is one of the few remaining areas in the world where viable populations of mussels exist, however, it has been estimated that if present rates of extinction continues due to a combination of over-fishing, increased siltation, eutrophication and negative impacts on host salmonid populations, then existing populations may only survive for a further 25 years, so it is essential that an improved understanding of the geomorphological and hydrological influences on the mussel is gained in order to conserve them.

There is limited understanding of the impact of the hydropower scheme, particularly with regards to the supply of fine sediment, the composition and distribution of substrates within the river channel and the stability of the channel banks. An improved understanding of the relationship between channel geomorphology and the distribution and conservation status of the freshwater pearl mussel is therefore required. This research aims to provide a baseline of information that will enable the implementation of future assessments of change, in addition to the recommendation of suitable restoration works, if required.

Hydrological characteristics of the Kerry were evaluated using data from the hydroelectric scheme, abstraction rates from the hatchery, past and current flow data. Lower flows are higher than would be expected in a natural catchment as a result of storage and consequent attenuation provided by the hydropower scheme. The fact that mussels are recruiting and surviving in the Kerry suggests that the effect of operations to date have been limited. A sensitivity regarding hatchery abstraction rates during low flow events is required as this may reduce upstream salmonid migration rates. Historical records of channel change were investigated by obtaining historical maps and aerial photographs. Analysis revealed that the Kerry has been relatively stable over time, with respect to its morphology and the position of the channel banks. This is particularly the case in the upper and lower reaches which are bedrock controlled. Some change, in terms of channel bank position has taken place in the middle, flat alluvial reaches. A fluvial audit was undertaken involving River Habitat Surveys (RHS) and sediment mapping. Direct sampling of the bed material had to be avoided because of the environmental sensitivity of the mussels. Digital photographic imagery methods were therefore utilised to assess the grain size distribution of surface sediment. Results indicate mussels have a positive association with mixed substrates (boulders, cobbles with pockets of fine gravel and sand) which are distributed throughout the river and there appears to be very little fine sediment (clay, silt) in the system which is beneficial for the mussels and host salmonid embryos as siltation causes suffocation. Future conservation issues (e.g. geomorphological, habitat, host fish) are highlighted.

## Guidelines for Depth Data Collection in Rivers when Applying Interpolation Techniques (Kriging) for River Restoration.

*P. Bellamy (1), D. Booker (2), M. Dunbar (2), I. Maddock (3), V. Merwade (4), M. Rivas (1) and S. White (1).*

*(1) Cranfield University at Silsoe, UK, (2) Centre for Ecology and Hydrology, UK, (3) University College Worcester, UK (4) Texas Water Development Board.*

### Summary

Temporal and spatial hydromorphological changes need to be assessed for river restoration projects. Changes are usually characterised through to qualitative assessment of hydromorphological variables. Quantification of hydromorphological changes is a difficult task since no methodology is available for this purpose. Thus, there is a need to find a tool for the quantification of the degree of difference between the original situation and the restored one.

This poster presents a potential strategy for the quantification of hydromorphological changes in time and space. The proposed strategy is based on the application of geostatistical analysis. Geostatistical analysis includes the study of the variogram cloud, the experimental variogram and the empirical variogram. The variogram cloud informs on the existent relation between the variance and the distance between pair of points for all the data points collected. The experimental variogram is obtained after averaging the variance of all the points that are separated a specific distance. Finally, the empirical variogram is the result of fitting a function to those points obtained for the empirical variogram. The information provided with each of these tools has been analysed at eighteen river sites for the depth hydromorphological parameter. A sensitivity analysis has also been developed for the empirical variogram.

Conclusions have been established according to (i) the differences encountered between river sites and (ii) the sensitivity analysis developed for the empirical variogram. Preliminary results show that the variogram cloud is a useful tool to identify characteristics of the river channel and to identify spatial and temporal differences. Less successful results have been obtained for the experimental and empirical variograms. Further research projects should be developed to apply the proposed tools to a specific case study.





## SUMMARIES OF WORKSHOPS



Workshop 1:

## **Integrating Sustainable Drainage Systems (SUDS) into River Restoration – Workshop**

*Robert Bray Associates Ltd*

*Sustainable Drainage Consultants and Landscape Architects*

*Email: bob@robertbrayassociates.co.uk*

*www.sustainabledrainage.co.uk*

### **Summary**

Sustainable Drainage Systems, or SUDS, is a new approach to managing rainfall that aims to control flooding, prevent pollution and provide amenity by using techniques such as filter strips, swales, filter drains, permeable pavement, infiltration devices, basins, ponds and wetlands.

SUDS uses the concept of the ‘management train’, with control techniques in series to enhance the character of runoff, as well as drainage at a ‘sub-catchment’ level and ‘source control’ to enhance the effectiveness of SUDS.

The approach offers great benefits to urban watercourses but is not being used universally in Britain and is often badly executed in practice.

The Scottish Environment Protection Agency (SEPA) is responsible for regulating Scotland’s environment including water quality in Scotland and promotes SUDS as part of a strategy to improve burns and rivers. Neil McLean, SUDS co-ordinator for SEPA, will provide a Scottish perspective on current practice.

This workshop seeks to:

- define the relevance of SUDS to the river restoration community and
- explore mechanisms for promotion of SUDS for river restoration benefits

Workshop sessions:

1. What are the benefits of SUDS to river restoration in order of priority
2. What design criteria will ensure SUDS meets river restoration objectives
3. What are the mechanisms to promote SUDS for river restoration
4. What are the perceived barriers to SUDS from the river restoration community

## Workshop 2:

### **Scottish Environment Protection Agency (SEPA)**

*Greig S. M. (Senior Policy Officer- Hydromorphology and River Engineering)*

*Richardson R. (Regulatory Implementation Specialist)*

*Marsden M. (Head of Water Policy)*

## **Summary**

*The WFD presents a number of significant challenges for those involved in restoring/managing freshwaters, including:*

- *Large spatial extent of pressures,*
- *Lack of monitoring information,*
- *Risks (environmental and economic) of implementing inappropriate remediation measures,*
- *Difficulties identifying causes of degradation (e.g. catchment verses local controls),*
- *Timetable for delivery,*
- *Cost of undertaking remediation/restoration activities,*
- *Variety of disparate groups involved in managing protecting freshwaters*

*Restoring the physical processes and forms that support 'good ecological status' will require the development of coordinated and measured responses from UK agencies, stakeholders, and other interested parties.*

*This SEPA led workshop will: (i) provide a forum for discussing the challenges facing those involved in restoring the UK's freshwaters, and (ii) provide a platform for informed discussion on how to apply river restoration principles to the challenge of meeting WFD requirements.*

## **Format**

The session will be structured around two presentations- the first focusing on policy and strategic considerations and the second focusing on technical challenges. Each presentation will identify a set of discussion topics:

**14:50 Presentation 1:** Overview of the Water Framework Directive and associated UK legislation.

**15:00 Discussion I:** Topics to include: Delivery timetable, identification of realistic objectives, methods to improve co-ordination of remediation effort, wider policy considerations.

**15:25 Presentation 2:** Overview of technical challenges

**15:35 Discussion II:** Topics to include: effective remediation planning; tools available to support remediation; practical hurdles to achieving remediation objectives; lessons learnt; gaps in knowledge;

## **16:00 Closing remarks**

At the end of the workshop, all attendees will be asked to complete a questionnaire.

The outputs from the workshop will be posted on the RRC webpage: [www.therrc.co.uk](http://www.therrc.co.uk)

## **Managing Partnership Projects**

*Jonathan Mycock (Hampshire County Council)*

*Email: jonathan.mycock@hants.gov.uk*

### **Summary**

#### **Introduction and background**

The successful restoration of rivers and wetlands frequently depends on individuals and organisations working together in partnership. Partners may come together to carry out joint projects, or work together on consultative panels and stakeholder groups. Within large organisations e.g. Government agencies, individuals from different parts of the organisation may come together to develop and take forward particular activities or services in support of a common purpose and mutual benefits.

Effective partnerships share knowledge, expertise, resources and risk to the benefit of the community, service users, funding bodies and participating partners. Partnerships have particular features and the application of appropriate tools and techniques can be important in enabling them to be managed effectively.

This workshop will explore partnerships and look at some of these methods, drawing on the experience and knowledge of the workshop leader and participants.

### **Objectives**

- To improve participants' awareness of the benefits of partnership working
- To share best practice in managing partnerships, including tools and techniques

### **Content**

- Explore some of the different types of partnership
- Identify the benefits (and pitfalls) of partnership working
- Define the stages of partnership development
  - Developing ideas; identifying needs
  - Finding partners
  - Agreeing ground rules; frameworks
  - Partnership life cycle
  - Life cycle as a project
- Look at some useful tools / techniques which might be used in each stage

## **Habitat Project Failures**

*Andrew Clarke*

*Email: Andrew.clarke@environment-agency.gov.uk*

### **Summary**

A colleague who has undertaken many habitat projects told me, "If 50% of the projects succeed you have done well". I would like to try to decrease the failure rate of habitat projects and one important factor is understanding why failures happen. We need examples of failures and to understand why the project failed. I have a few examples, not all mine! We need other examples.

Many habitat problems are similar on different river catchments and similar remedial work is undertaken by catchment trusts, statutory bodies, owners, angling clubs and individuals. Where failures occur understanding the reasons and then disseminating the information can help stop the failure being repeated and help in the design of a successful projects.

What are the reasons for failure?

1. Habitat problem identification. In the past work has been carried out on gut feeling or poor analysis of the problem. Example: Salmonid ova survival in redds was thought to be poor on the R. Wyre. The solution was stocking with hatchery reared fish. These fish that were at times stocked into acid stressed areas of the catchment were they could not survive. Collection of data to analyse the problems needs to be robust and this data gives the baseline to prove the solution has worked.
2. Funding. Many projects fail because funding is not obtained for the project. Dove tailing projects to different funding streams can be difficult. The length of time to release funds and spending deadline dates can mean projects being undertaken at less than optimum times. Example: The length of time from project design to obtaining funding on River Keer was 5 years. By this time some of the problems had changed and it was difficult to change the original accepted bid.
3. Project design. Failure in project design can occur in many ways.
  - a. The first is navigating the legal maze of different legalisation. In England there are European directives like Birds and Habitats Directives and Water Framework Directive. Parts of these directives are incorporated into Acts of Parliament and other legislation has been enacted. Wildlife and Countryside Act 1981 and Crow Act 2000 are examples. Siting of projects in designated sites can have major implications on how the project is implemented. The next tier is getting the correct consents and licences from the different statutory bodies. Land drainage consents and abstraction licences are sometimes needed. Then there is government guidance to follow which exceeds statutory requirements and effects of habitat projects may have adverse effects on other species.
  - b. Design details of the project have to be site specific and what works at one site may not work at another.
4. Project implementation. Incorrect timing wrong materials and poor workmanship can all cause failure.
5. Monitoring and dissemination. If you can't prove the projects worked it can't be used to model future projects and used to gain further funding. If no body else knows about it they can't use it.

Can delegates bring powerpoint photos and /or details on disc or flash drive of failed projects and contact me before the workshop.

## THE RIVER AVON INITIATIVE-STREAM AND THE LIVING RIVER PROJECT

*Jenny Wheeldon*  
*STREAM Project Manager*  
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*jenny.wheeldon@english-nature.org.uk*



The River Avon, its main tributaries and river valleys are one of the best river systems for wildlife in the UK. The river system flows through a region of outstanding natural and cultural heritage, with the Wiltshire tributaries converging in Salisbury, and meeting the sea at Christchurch. They support habitats and species listed in UK and local Biodiversity Action Plans, and are of national and international importance, with SSSI, SAC and SPA designations.

The natural heritage of the Avon system is threatened by many factors, such as historical engineering work, pollution from agricultural and other sources, low flows, and abstraction. These impacts are directly or indirectly the result of people's actions and demands on the river system, and securing long-term solutions will require a widespread increase in understanding.

A Conservation Strategy for the River Avon SAC (published 2003) identified measures in place to address the impacts, and gaps where new action is needed. It has generated two major partnership projects: the STREAM LIFE-Nature Project focussing on restoration of the SAC (running since September 2005) and the Living River Project which focuses on wider biodiversity of the River Avon system and engaging communities with its conservation.

### **Strategic restoration and management (STREAM)-Restoring the River Avon Special Area of Conservation**



£1 million has been secured from the European Commission's LIFE-Nature programme to support river restoration on the internationally protected River Avon Special Area of Conservation (SAC) in Wiltshire and Hampshire. English Nature is working with project partners the Environment Agency, Wiltshire Wildlife Trust, Hampshire & Isle of Wight Wildlife Trust and Wessex Water.

The STREAM Project will demonstrate river restoration throughout the River Avon system. The restoration sites were selected with the help of the River Restoration Centre through a catchment-wide appraisal and prioritisation process. This used survey, biological and physical data to identify the river reaches most heavily damaged by previous detrimental management, in particular channel engineering.

The four year STREAM project will:

- Demonstrate and monitor river restoration at six sites, covering 7km.
- Link management of the lower reaches of the river with the floodplain.
- Disseminate best practice to UK and European river managers and specialists
- Undertake public open days to raise awareness of the river system and the project in the local community.

## The Living River

A funding bid for a “Living River” Project was recently submitted to the Heritage Lottery Fund. It aims to increase awareness and appreciation of the River Avon system, particularly among people living in the catchment, and focuses on how the natural heritage of the river system has developed through people’s use of it through the ages.



The Living River Project will involve people throughout the River Avon catchment with the conservation of its natural heritage. The project will tell the story of the River Avon system and how its exceptional natural heritage has developed alongside the world famous cultural heritage of the area. It will invest resources from a range of partners in long-lasting improvements to biodiversity and access to the heritage, and will use innovative methods to engage audiences across the catchment and secure their support for its conservation.

A funding bid was submitted to the Heritage Lottery

Fund on 2005, and decision is expected in June 2006.

The Project will target four audiences: river managers, users, influencers and the wider public, and will involve them throughout the project in restoring, monitoring and making decisions about the natural heritage. The project development process has engaged stakeholders throughout, and has already forged new relationships: implementing the project itself will strengthen these relationships and develop new interactions between the different audiences, especially at community level.

Through an innovative suite of actions the Living River Project will complete 3 programmes:

- Biodiversity restoration - at sites the public can access and enjoy
- Access and Interpretation – creating and enhancing physical and intellectual access to the natural heritage across the river system
- Education and Training – providing education events and resources, and offering training opportunities to help people understand their relationship with the river system and take responsibility for it

The Project will demonstrate how a complex and largely privately owned natural heritage asset can be made widely accessible to a range of audiences.

### Contact

Martin Gilchrist 01380 725670, [marting@wiltshirewildlife.org](mailto:marting@wiltshirewildlife.org)



## **LIST OF DELEGATES**

### **RRC Staff ( Conference Organisers)**

<b>Name</b>		<b>Job Title</b>
Martin	Janes	Centre Manager
Jenny	Mant	Projects Adviser
Alice	Fellick	Information Officer
Joanne	Evason	Centre Administrator
Audrey	Johnson	Assistant Administrator

### **DELEGATES**

<b>Name</b>		<b>Organisation</b>	<b>Job Title</b>
Caroline	Anderson	JBA Consulting	Analyst
Elly	Andison	Environment Agency - North East Region	
Romi	Anku	Lund Institute of Technology - Lund University	Masters Student - Water Resources Engineering
Ernest			
Faraj	Arfa-Zangeneh	WA Fairhurst & Partners	Project Engineer
Valerie	Bain	HR Wallingford Ltd	River Engineer
Chris	Baker	Envirocentre Ltd	Hydrologist
David	Bamford	Environment Agency - North East Region	Fisheries Technical Officer
Judith	Bankhead	Rivers Agency	Conservation Officer
Joanne	Barlow	Jacobs Babtie	Geomorphologist
Lindsay	Beevers	Jacobs Babtie UK Ltd	Engineer / Modeller
Sergey D	Belayeu	Russian Research Institute for Integrated Water Management and Protection - RosNIIVKh	
Phil	Belfield	Environment Agency -Thames Region	Fisheries Officer
Chris	Bell	Environment Agency	Fisheries Officer
Jennie	Benger	Environment Agency	Regional Asset Investment & Planning Team Member 1
Roger	Bettess	HR Wallingford Ltd	Principal Scientist
Jeremy	Biggs	The Ponds Conservation Trust: Policy & Research	
Will	Bond	Alaska Environmental Contracting Ltd	
Phil	Boon	Scottish Natural Heritage	Principal Freshwater Advisor
Brian	Booth	Ballinderry Fish Hatchery	Hatchery Technician
Robert	Bray	Robert Bray Associates	Landscape Architect
Philip	Brewin	Somerset Drainage Boards	Ecology Officer
Emma	Broad	Environment Agency - Midlands Region	
Andrew	Brookes	Jacobs UK Ltd	Technical Director
Jane	Brookhouse	RSPB - West Sedgemoor Reserve Office	Area Reserves Manager (Devon, Somerset & Wiltshire)
David J	Brown	Environment Agency - North West Region	Geomorphologist
Beverley	Brown	Environment Agency	Regional Asset Investment & Planning Team Member 1
Christopher	Burns	Environment and Heritage Service	Scientific Officer
John	Burrow	Scottish Natural Heritage	Area Officer
Simon	Cain	Cain Consultancy	Executive Consultant
Wendy	Campbell	SEPA	

<b>Name</b>		<b>Organisation</b>	<b>Job Title</b>
Alessandro	Cappelli	CIRF - Italian Center for River Restoration	Hydraulic Engineer
Matt	Carter	Environment Agency - Thames Region	Fisheries & Biodiversity Team Leader
Steve	Carter	Environment Agency	Technical Officer
Pippa	Caswell	Environment Agency - Anglian Region	Technical Officer, Fisheries Recreation Biodiversity
Liz	Chalk	Environment Agency - North East Region	Technical Specialist (Biodiversity)
Ros	Challis	Environment Agency - Midlands Region	Ecological Appraisal Team Leader
Robin	Chase	Cain Consultancy	Senior Consultant
Andy	Clarke	Environment Agency - North West Region	Fishery Officer
David	Clarke	Loughs Agency	River Watcher
Lesley	Clarke	Environment Agency - Anglian Region	Senior Environmental Assessment Officer
Ruth	Clarricoates	Environment Agency	Technical & Project Support Officer
Steve	Colclough	Environment Agency - Thames Region	Fisheries
David	Colvill	SEPA	Ecologist
Luke	Comins	Tweed Forum	Project Officer
Kieran	Conlan	Cascade Consulting	Managing Director
Tom	Cook	Environment Agency	Biodiversity Officer
Kate	Cook	Halcrow Group Ltd	Assistant Planning Supervisor
David	Corbelli	SEPA	Senior Hydro Ecologist
Alison	Crang	Environment Agency	Environmental Assessment Officer NEAS
Andrew	Crawford	Environment Agency - Midlands Region	Biodiversity Technical Specialist
Susan	Crawford	Angus Council	Graduate Engineer
Charles	Crundwell	Environment Agency - Midlands Region	Technical Specialist Fisheries
Joanna	Cubbage	Aberdeenshire Council	Engineer
Seamus	Cullinan	Loughs Agency	Inspector
Jo	Cullis	Environment Agency - South West Region	Technical Officer
Robert	Cunningham	RSPB	Senior Water Policy Officer
Marina	Curran-Colthart	Argyll and Bute Local Biodiversity Partnership	Biodiversity Project Officer
Sarah	Currie	Tweed Forum	Tweed Catchment Management Plan Project Officer
Kathy	Dale	Northern Ecological Services	Senior Ecological Consultant (Associate)
Steve	Dangerfield	Cascade Consulting	
John	Darbyshire	JDC Ecology Limited	
James	Davidson	SEPA	Habitat Enhancement Specialist
Derek	Davidson	Angus Council	Assistant Engineer
Eva	Deseo	Ministry of Environment and Water	Chief Counsellor
Marie	Donald	SEPA	Ecologist
Sally	Donaldson	SEPA	Ecologist
Bjorn Otto	Donnum	NJFF -Akershus	Consultant
Richard	Dooley	Office of Public Works	Engineer Grade I Environment Section
Stuart R	Downward	Kingston University	University Lecturer
John	Drake	Halcrow Group Ltd	Associate Director

<b>Name</b>		<b>Organisation</b>	<b>Job Title</b>
Rob	Dryden	Environment Agency - Anglian Region	Conservation Officer
Chris Richard	Dyson Edwards	Countryside Council For Wales SALIX River & Wetland Services Ltd	Regional Rivers Specialist, South & East
Maxine	Elliott	Environment Agency - Southern Region	New Forest LIFE 3 Project Manager
Lucy	Ellis	Atkins Ltd	Geomorphologist
Hugh	Ellis	Maccaferri Ltd	Erosion and Ecology Specialist
Judy	England	Environment Agency -Thames Region	Ecological Appraisal Team Leader
Luke Ronnie	Engleback Falconer	STUDIOENGLEBACK Jacobs Babbie UK Ltd	Senior Consultant - Flood Risk & River Basin Management
Karen Vanessa Charles	Fisher Ford Forman	KR Fisher Consultancy Ltd WA Fairhurst & Partners Environment Agency - North East Region	Ecohydraulics Consultant Graduate Engineer Environment Assessment Officer
Allan	Frake	Environment Agency - South West Region	Technical Specialist
Luke Chris Karen	French Gall Galtress	Buccleuch Estates Ltd SEPA Department of Agriculture Fisheries & Forestry, Isle of Man Government	Land Agent River Management Project Officer
Steve	Garner	Environment Agency - North West Region	Team Leader - Conservation/ Area Fisheries, Ecology and Recreation Manager (acting for Cameron Durie)
Sally Jonty	German Gibson	ARUP Environment Agency - Head Office	Senior Scientist Hydromorphology Policy Adviser
Andrew Nathy David Joanna Anthony Garth Stuart Claire Edward	Gill Gilligan Gilvear Gray Green Greer Greig Grisaffi Hall	Cranfield University Silsoe Office of Public Works University of Sterling Halcrow Group Ltd JBA Consulting Rivers Agency - Northern Ireland SEPA Halcrow Group Ltd AWM - Amenity Water Management	Lecturer Engineer Grade II Environment Section Senior Lecturer Project Manager Principle Engineer Conservation Officer Senior Scientist (Hydromorphology) Project Engineer Director
Arne T	Hamarsland	Norwegian Water Resources & Energy Directorate	Senior Advisor
Elaine Richard	Hamilton Handley	SEPA Environment Agency	Principal Officer - Biodiversity & Conservation
Rachel	Harding	Environment Agency - North West Region	Biodiversity Technical Officer / Ecologist
Matthew Oliver	Hardwick Harmar	Haskoning UK Ltd Halcrow Group Ltd	River Scientist - Fluvial Geomorphologist Water Resources Planning, Modelling and Hydrology
S M Emma Francis Alexandra	Haslam Hay Hayes Hazel	University of Cambridge Scottish Natural Heritage SEPA Environment Agency - Thames Region	Dept of Plant Sciences Area Officer WFD Specialist 2 Trainee Conservation Officer

<b>Name</b>		<b>Organisation</b>	<b>Job Title</b>
Joanna	Heisse	Environment Agency - Thames Region	Conservation Officer
Andy Ian	Hemmingway Hirst	SEPA Environment Agency - Anglian Region	Technical Specialist Fisheries Recreation Biodiversity
David	Holland	SALIX River & Wetland Services Ltd	
Mark Andrew Duncan	Horton House Huggett	Ballinderry Fish Hatchery Wessex Water Environment Agency	Co-Ordinator of New Projects Senior Environmental Scientist Habitats Policy Advisor, Flood Risk Management Policy
Isobel Heather Richard Matt	Hunt Jackson Jeffries Jones	Wildmark SEPA Gifford and Partners Ltd Environmental Assessment & Design	Consultant Ecologist Director
Huw Tony Zoltan Ros	Jones Judge Karacsonyi Kaye	Environment Agency - Wales Atkins Ltd University of Debrecen Environment Agency - Midlands Region	Biodiversity Officer Engineer director Biodiversity Officer
Richard Sally-Beth Angela Jimmy Aleksy Y	Kehoe Kelday Khalil King Kosolapov	Scottish Natural Heritage Jacobs UK Ltd Black & Veatch Ltd Central Fisheries Board Northern Caucasus Research Institute for Water Management & Protection (SevKavNIIVKh)	Area Officer Environmental Scientist Fisheries Biologist Director
Steve	Lane	Environment Agency - Anglian Region	Technical Officer, Fisheries, Recreation & Biodiversity
Fiona	Lang	Environment Agency - North West Region	Flood Defence Officer
Alastair	Laverty	Environment Agency - North East Region	Technical Officer Biodiversity
David Jo Oliver	Lister Long Lowe	SEPA SEPA Environment Agency - North West Region	Senior Ecologist Flood Defence
Leena Margarida Xavier	Luis Tomas	National Museum of Natural History and Botanical Garden	PhD Student
Sally Chris Jim Alasdair Linda Marcus	Mackenzie Mainstone Martin Matheson Mathieson McAuley	Halcrow Group Ltd English Nature Rivers Agency - Northern Ireland SEPA Aberdeenshire Council Department of Culture, Arts and Leisure Inland Fisheries Branch	Ecological Consultant Senior Freshwater Ecologist Environmental Manager Senior Hydromorphologist Environment Planner (Strategic)
Nicki David Graeme	McIntyre McKenna McLaren	Scottish Natural Heritage Taylor Young Ltd Environment Agency -Thames Region	Area Officer Senior Landscape Architect Technical Specialist Conservation
Ute Claire Christian	Menke Moore Moritz	ECRR ARUP ARGE Limnologie	RWS-RIZA/ECRR secretariat Civil Engineer

<b>Name</b>		<b>Organisation</b>	<b>Job Title</b>
Joe	Morris	Cranfield University Silsoe	Resource Economics and Management
Alastair	Morriss	John Young Associates Ltd	Environmental Scientist
Deirdre	Murphy	Flood Management Division - DEFRA	Ripon Multi Objective Project Officer
Patrick	Murphy	Environment and Heritage Service	Scientific Officer
Jonathan	Mycock	Hampshire County Council	LIFE3 Project Manager
Attila	Nagy	Institute of Geography, University of Pecs	PhD Student
Ruth	Needham	OnTrent	OnTrent Project Manager
Arthur	Nivan	Loughs Agency	Angling Manager
Mark	Noonan	Office of Public Works	Engineer Grade Three - Drainage Maintenance
Martin	O'Grady	Central Fisheries Board	Senior Research Officer
Robert	Oates	WWF	UK Natural Rivers Co-ordinator
Alfons	Oberhofer	Atelier Oberhofer	Architects & Landscape Planners
Carina	Oliver	Haskoning UK Ltd	Environmental Scientist
Glyn	Onione	British Flora	Managing Director
Steve	Ormerod	Cardiff University	Professor of Ecology
Andrew	Pepper	ATPEC River Engineering Consultancy	Director
Tim	Pickering	Environment Agency	Project Manager
Stephanie	Pielot	Environment Agency - Southern Region	Biodiversity Officer
Sally	Powell	Environment Agency - North East Region	Environment Assessment Officer
Neil	Punchard	Wessex Water	Environmental Scientist
Jo	Ratcliffe	Environment Agency - North West Region	Recreation Officer
Marq	Redeker	Ruhr River Association (Ruhrverband)	Civ. Engineer, Assistant Head of Sorpe & Henne Dam Branch
Walter	Redl	HA45 - Wasserbau - Abteilungsleiter	Senatsrat Dipl.-Ing
Roy	Richardson	SEPA	WFD Implementation Manager
Monica	Rivas-Casado	Cranfield University Silsoe	PhD Student
Brian	Rochford	Environment Agency -Thames Region	Project Engineer
Paul	Sadowski	Environment Agency - North West Region	Development Control
Ileana	Schipani	CIRF - Centro Italiano Per La Riqualificazione Fluviale	River Ecologist
Lian	Scholes	Flood Hazard Research Centre	Flood Hazard Research Fellow
Fotis	Sgouridis	Queen Mary, University of London	PhD Student
Andrea	Shaftoe	Environment Agency - North East Region	Principal Officer Conservation & Biodiversity
Irina L	Shalyapina	Russian Research Institute for Integrated Water Management and Protection - RosNIIVKh	Engineer
John	Shillcock	Dr D J Shillcock	Environmental Consultant / Director of operations (RRC)
Matthew	Simpson	Wetlands Advisory Service	Senior Wetland Eco-Hydrologist
Kevin	Skinner	Haycock Associates Ltd	Senior Consultant
Tim	Smith	Department of Natural Resources	Riverine Officer (Resource Access)
Alasdair	Smith	Aberdeenshire Council	Principle Engineer
Emma	Smith	Halcrow Group Ltd	Geomorphologist

<b>Name</b>		<b>Organisation</b>	<b>Job Title</b>
Allan	Snape	Northumbrian Water plc	Technical Adviser - EA Liaison
Robin	Snowdon	University of Gloucestershire	Lecturer in Landscape & Design
Chris	Spray	SEPA	Director of Environmental Science
Colin	Street	Environment Agency	Specialist Team Member
Anthony	Sykes	Environment Agency - North East Region	Fisheries Technical Officer
Rhian	Thomas	Countryside Council for Wales	Freshwater Ecologist
Emma	Thompson	Environment Agency	Technical Officer 1 (Biodiversity)
Kirsten	Thorburn	SEPA	WFD Spec11 Regulatory Implementation Team
Colin	Thorne	University of Nottingham	Chair of Physical Geography
Angus	Tree	Scottish Natural Heritage	Freshwater Adviser
Julie	Tuck	SEPA	WFD Ecologist
Jon	Turner	Countryside Council for Wales	Senior Conservation Officer, Afon Teifi SAC
Richard	Tyner	Environment Agency -Thames Region	Fisheries Technical Specialist
Lucy	Van Der Ven	Halcrow Group Ltd	Engineer
Daniela	Viveash	Environment Agency	Environmental Assessment Officer NEAS
Rebecca	Wade	University of Abertay Dundee	Research Fellow
Jim	Walker	Environment Agency - Head Office	Technical Specialist (Flood Risk Mapping & Data - National Geomorphologist (Conservation & Ecology)
John	Webb	Atlantic Salmon Trust	Field and Research Biologist
Mike	Wells	Biodiversity by Design Ltd	Director
Andy	Went	Environment Agency - Thames Region	Fisheries Officer
Jack	West	Angus Council	Design Engineer
Jenny	Wheeldon	English Nature	Project Manager, STREAM
Karen	White	Atkins Water	Fluvial Geomorphologist
Simon	Whitton	Environment Agency - Thames Region	Fisheries Projects Development Officer
Mike	Williams	Environment Agency - South West Region	Conservation
Abigail	Williamson	Environment Agency	Senior Environmental Assessment Officer - NEAS
Duncan	Wishart	Jacobs Babtie	Senior Geomorphologist
Peter	Worrall	Penny Anderson Associates	Technical Director
Robert	Wray	Loughs Agency	Inspector
Nigel	Wright	UNESCO-IHE	Professor



