The RIVER RESTORATION CENTRE'S 8th ANNUAL NETWORK CONFERENCE

River restoration as a measure to deliver sustainable Flood Risk Management (FRM) and Water Framework Directive (WFD) objectives

Wednesday 18th April – Thursday 19th APRIL 2007
Site visit Friday 20th April 2007

University of Chester
England

Sponsored by Alaska Environmental Contracting, Halcrow, Jacobs, Penny Anderson Associates and Salix River & Wetland Services

Contents

PROGRAMME

The River Restoration Centre 8th Annual Network Conference 2007
University of Chester

Day 1: Wednesday 18th April 2007

9.10 – 10.30	REGISTRATION & TEA/COFFEE	
Main Auditorium (Binks Lecture Theatre 006)		
CHAIR	**Roger Bettess** (*HR Wallingford/RRC Board Member*)	
10.40	**RRC Introduction:** Martin Janes (RRC).	5 mins
10.45	**Welcome:** Andrew Pepper (*RRC Chairman*).	15 mins
11.00	**Opening Address:** Phil Rothwell (*Environment Agency*).	15 mins
11.15	**Keynote Speaker:** Richard Hey (*University of Birmingham*). Evaluation of procedures for sustainable river restoration to meet WFD and FRM objectives. (In association with Katarina Holubova (*Water Research Institute, Slovakia*)).	25 mins
11.40	**Discussion**	10 mins
11.50	**Interval**	10mins
Main Auditorium (Binks Lecture Theatre 006)		
Session 1	**River Restoration: Flood Risk Management, Water Framework Directive and Water Policy Objectives**	
CHAIR	**Mervyn Bramley** (*External Adviser to Environment Agency/RRC Board Member*)	
12.00	David Collins (*DEFRA*). Catchment scale habitat management in the Murray basin, Australia.	15 mins
12.15	Tony Green & Anna Curini (*Jeremy Benn Associates*) & Richard Leishman (*Natural England*). The River Wensum SSSI restoration strategy.	15 mins
12.30	**Discussion**	10 mins
12.40	Roger Bettess (*HR Wallingford/RRC Board Member*), Mervyn Bramley (*External Adviser to Environment Agency/RRC Board Member*), Caroline McGehey, Jonathan Simm & Michael Wallis (*HR Wallingford*). Channel performance assessments as a means of delivering flood risk management and water framework directive objectives.	15 mins
12.55	Richard Jeffries & Stuart Greig (*SEPA*). Delivering WFD objectives - making the leap from jargon to action.	15 mins
13.10	**Discussion**	10 mins
13.20	LUNCH (Small Hall)	1 hr

Session 2 commences at 14:30 (parallel sessions – see next page of programme)

Please allow sufficient time to get to your chosen session

Allowances are made in the schedule to move between rooms, times listed are session start times.

Session 2	**A – River Restoration Addressing Sustainable Solutions** **Main Auditorium (Binks Lecture Theatre 006)**	**B – Achieving River Restoration Objectives: a Scottish Perspective** **Second Auditorium (Binks Lecture Theatre 1.07)**	
CHAIR	**Geraldene Wharton** (*Queen Mary, University of London/RRC Board Member*)	**Oliver Harmar** (*Halcrow Group*)	
14.30	Janine Castro (*River Restoration Northwest and Portland State University*). Floodplain creation through excavation: aggregate extraction, flood protection and habitat creation in the Pacific Northwest region of the U.S.	Will Bond (*Alaska Environmental Contracting*) & Dominic Funnell (*RSPB Scotland*). Making the most of the execution phase of a river restoration project in North East Scotland.	15 mins
14.45	Jaap Flikweert (*Royal Haskoning*) & Cor Beekmans (*Rijkswaterstaat*). Space for rivers: The Dutch approach to flood risk management, from policy to implementation.	Lorraine Wilson & Dominic Funnell (*RSPB Scotland*), Will Bond (*Alaska Environmantal Contracting*) & Andrea Johnstonova (*RSPB Scotland*). WFD and Natura: restoring a designated site to benefit biodiversity and deliver improved water level management.	15 mins
15.00	Patricia Xavier & Catherine Wilson (*Cardiff University*), Huw Thomas & Tom Nisbet (*Forest Research*). Restored Floodplain Woodland on the River Laver, North Yorkshire: A benefit or drawback to flooding in Ripon.	Lindsay Beevers & Duncan Wishart (*Jacobs UK*). The influence of the CAR Regulations on river engineering proposals: recent experiences.	15 mins
15.15	**Discussion**	**Discussion**	15 mins
Session 3 15.30	POSTERS & TEA/COFFEE (Small Hall)		40 mins

Session 4 commences at 16:10 (parallel sessions – see next page of programme)

Please allow sufficient time to get to your chosen session

Allowances are made in the schedule to move between rooms, times listed are session start times.

Session 4	A - River Management: the Bigger Issue **Main Auditorium (Binks Lecture Theatre 006)**	B - Flood Risk Management: Ecological Approaches **Second Auditorium (Binks Lecture Theatre 1.07)**	
CHAIR	**David Sear** (*University of Southampton*)	**Allan Frake** (*Environment Agency*)	
16.10	Eleanor Andison, Neil Trudgill & Rachel Hughes (*Environment Agency*). Planning for whole river restoration projects: physical improvements alongside river stewardship.	David Oldmeadow & Carina Oliver (*Royal Haskoning*). Should we consider small scale bedform structures on the river bed as part of wider scale river engineering / restoration projects?	15 mins
16.25	Patrick Woods, Matthew Hardwick, Jaap Flikweert, Helen Dangerfield & Helen Stark (*Royal Haskoning*). Challenges and opportunities for river restoration in a catchment: thoughts from Catchment Flood Management Plans.	Nathy Gilligan (*Office Public Works*). Hydromorphology and flood risk management in Ireland focusing on rock ramps as a sustainable solution.	15 mins
16.40	Lidija Globevnik (*Institute for Water of the Republic of Slovenia*). The restoration of the Mura river in Slovenia - scientific, technical and political aspects of the implementation.	Andrew Pepper (*ATPEC River Engineering Consultancy/RRC Chairman*). "As neat as a new Pinn".	15 mins
16.55	**Discussion**	**Discussion**	15 mins
	Return to Main Auditorium (Binks Lecture Theatre 006)		10 mins

Main Auditorium (Binks Lecture Theatre 006)

Session 5	Can River Restoration deliver Water Framework Directive Objectives?	
CHAIR	**Nigel Holmes** (*Alconbury Environmental Consultant*)	
17.20	David Corbelli (*Environment Agency*). The development of a catchment approach to habitat restoration.	15 mins
17.35	Karen White (*Atkins*). Hydromorphology and the water framework directive - can river restoration provide the answers?	15 mins
17.50	**Discussion**	10 mins
18.00	**Open Discussion**	30 mins
18.30	**End of Day 1**	

Allowances are made in the schedule to move between rooms, times listed are session start times.

19.30 **CONFERENCE DINNER (Dining Hall)**

19.30 for 19.45

Bar extension until 01.00

PROGRAMME

The River Restoration Centre 8th Annual Network Conference 2007
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Day 2: Thursday 19th April 2007

8.30 – 8.50	REGISTRATION	
Main Auditorium (Binks Lecture Theatre 006)		
CHAIR	**Martin Janes** (*RRC*)	
9.00	**Welcome & Introduction to Day 2:** Martin Janes (*RRC*).	5 mins
9.05	**Keynote Speaker:** Mark Turner (*Mersey Basin Campaign*). The Mersey Basin Campaign: local action to deliver the objectives of the Water Framework Directive.	20 mins
9.25	**Discussion**	10 mins
Session 6	**Monitoring**	
Main Auditorium (Binks Lecture Theatre 006)		
CHAIR	**Karen Fisher** (*KR Fisher Consultancy/RRC Board Member*)	
9.35	Jenny Mant, Alice Fellick & Martin Janes (*RRC*). A way forward for integrated physical and ecological monitoring?	15 mins
9.50	Geraldene Wharton (*Queen Mary, University of London/RRC Board Member*), Claire Hulbert (*Queen Mary, University of London*) & Richard Copas (*Environment Agency*). Appraising urban river restoration projects: the Quaggy river at Sutcliffe Park, southeast London.	15 mins
10.05	**Discussion**	10mins
10.15	David Sear, Duncan Kitts & Cath Millington (*University of Southampton*), Maxine Elliott, Tim Holzer & Mike Mullins (*Environment Agency*). Ecohydrology and the flood risk management implications of wet woodland restoration.	15 mins
10.30	John Gollan (*Australian Museum, Sydney & University of New England, Australia*), Lance Wilkie & Chris Reid (*Australian Museum, Sydney*) & Lisa Bruyn & Nick Reid (*University of New England, Australia*). Assessing monitoring tools for evaluating biodiversity outcomes of riparian rehabilitation: approaches and alternatives from a river down-under.	15 mins
10.45	**Discussion**	15 mins
11.00	TEA & COFFEE (Small Hall)	30 mins
11.30	**Session 7 A, B, C – Parallel Sessions (see page 7)**	1.05 hrs
12.35	LUNCH (Small Hall)	1.10 hrs

Day 2 - PARALLEL SESSION PROGRAMME

Session 7	A – Sediment Management & Restoration	B – Valuing Your Community	C - River Restoration: European Case Studies	
	Main Auditorium (Binks Lecture Theatre 006)	**Second Auditorium (Binks Lecture Theatre 1.07)**	**Third Auditorium (Binks Seminar Room 1)**	
CHAIR	**Jo Shanahan** (*Atkins*)	**Susan Casper** (*Environment Agency*)	**Jim Walker** (*Environment Agency/RRC Board Member*)	
11.30	Andrea Nardini (*Italian Centre for River Restoration*). "Planning a physical setting able to reduce hydro-morphological risk in the aggressive Gesso stream (Piemonte, I) through river restoration looks economically rewarding".	Matt Cook & Joe Morris (*Cranfield University*). Principles and techniques for the economic valuation of river restoration projects.	Katarina Holubova (*Water Research Institute, Slovakia*), M. Lisicky (*Institute of Zoology, Slovakia*) & Richard Hey (*University of Birmingham*). Rehabilitation of the Morava river to enhance natural river functions and flood defense.	15 mins
11.45	Alex Henshaw & Colin Thorne (*University of Nottingham*). Catchment restoration for flood risk and sediment management: Pontbren, mid-Wales.	Mike O'Kell (*Chester City Council*). 'The QUERCUS project'.	Alfons Oberhofer (*Atelier Oberhofer, Austria*). Bilateral general project Morava II (BGM II).	15 mins
12.00	Oliver Harmar (*Halcrow*), Colin Thorne (*University of Nottingham*), Kevin Knuuti (*U.S. Army Corps of Engineers*) & Chester Watson (*Colorado State University*). Post Katrina: the importance of sediment to managing restoration of the lower Mississippi river delta.	Nigel Pilkington & Andy Yarde (*Faber Maunsell*). River restoration on the river Witham – seeing the bigger picture.	Ulrike Goldschmid (*Wilfried Fellinger, Austria*). Living river Liesing – Is rehabilitation of a heavily modified waterbody in an urban environment possible? Results of a LIFE-Project.	15 mins
12.15	**Discussion**	**Discussion**	**Discussion**	20 mins
12.35	**Lunch (Small Hall)**			

Allowances are made in the schedule to move between rooms, times listed are session start time

Session 8	A – River Restoration meets Flood Risk Management **Main Auditorium (Binks Lecture Theatre 006)**	B – Lowland Rivers: Drivers for Change **Second Auditorium (Binks Lecture Theatre 1.07)**	
CHAIR	**Jenny Mant** (*RRC*)	**Martin Janes** (*RRC*)	
13.50	Tiny Arts (Municipality *of Bergen op Zoom, the Netherlands*). Blue and green, adding quality to urban life. Blue-green algae frustrating urban ambitions.	Claire Redmond (*Environment Agency*), Lucy Brooksbank (*Jacobs UK*) & Jim Anderson (*Environment Agency*). Boston combined strategy: maximizing opportunities and having measurable targets so that success can be monitored.	15mins
14.05	Joanna Gray & Peter Martin (*Halcrow*). Lower River Roding Regeneration.	Ian Hirst & Paul Jose (*Environment Agency*), Chantal Hagen (*Natural England*) & Ian Cowx (*Hull International Fisheries Institute*). The Great Ouse Vision.	15mins
14.20	**Discussion**	**Discussion**	15 mins
14.35	Move to Workshops		15 mins
14.50	**Workshops**		1.20 hrs
16.10	Return to Main Auditorium (Binks Lecture Theatre 006)		10 mins
16.20	**Final Words and Close**		10 mins
16.30	******** **End of Conference** ******** TEA & COFFEE (Small Hall)		

Main Auditorium (Binks Lecture Theatre 006)

17.00	**Site Visit Introductions** Only applicable to delegates staying for site visits on the third day	30 mins
17.30	**End of Day 2 and evening arrangements**	

Allowances are made in the schedule to move between rooms, times listed are session start times.

Delegates staying for the site visit have the evening free to explore Chester

EVALUATION OF PROCEDURES FOR SUSTAINABLE RIVER RESTORATION TO MEET WFD AND FMR OBJECTIVES

Professor Richard Hey (r.hey@bham.ac.uk), School of Geography, Earth and Environmental Sciences, University of Birmingham, Edgbaston, Birmingham B15 2TT, UK.
Dr. Katarina Holubova, Water Research Institute, nbar. L. svobodu 5, 81249 Bratislava, Slovakia.

The WFD provides us with an unparalleled opportunity to rectify the adverse ecological impacts on our rivers following centuries of exploitation. While water quality is a necessary condition for achieving good ecological status for river systems, the re-instatement of their hydromorphology is a key issue and is the one being addressed in this presentation.

Returning rivers to a natural stable state requires an understanding of the factors and processes controlling their morphology. To be stable, the controlling factors have to be invariant. Consequently, if the controlling factors have been naturally or artificially changed over time, restoring a river to its original pristine state is not achievable. Instead it can be returned to a sustainable natural state, given the current stable controlling factors and any artificial constraints imposed on them by flood control, land drainage, water resource development and navigation.

To achieve the WFD objectives, it is necessary to assess the hydromorphological status of rivers in the EU in terms of their degree of departure from a pristine state. However, this presupposes that the appropriate pristine condition can be identified following years of tinkering. It also requires EU collaboration to designate a common standard for 'good' status across a range of river types. This acknowledges that rivers vary reflecting spatial variations in the factors and processes controlling them. Some form of river categorisation is required to undertake the necessary assessments and it would be sensible if a common procedure could be adopted across the EU to ensure comparability. Given the scale of the exercise, and the limited time frame, the assessment has to be undertaken rapidly, potentially from maps and aerial photographs with some limited ground truth. River classification provides an appropriate tool for this purpose and there are several possible contenders.

The UK is advocating the use of Montgomery and Buffington's classification scheme, rather than Rosgen's, as it is based on channel processes rather than on the form of the river and, thereby, was perceived to have more utility. Closer inspection of the two procedures indicates that the former is based on a false premise regarding channel adjustment processes and that the variations in form used by the latter to distinguish between river types do indeed depend on changes in the controlling factors and processes. Experience using Rosgen's classification procedure in the UK indicates that surveys can be very rapidly undertaken and that it has universal application, even in heavily engineered rivers. Not only does it enable the status of rivers to be identified, but also their degree of departure from a pristine state. The lack of an appropriate local reference reach to define a 'good' status is not an issue as such information can be transferred from another continent.

Restoring rivers to a 'good' ecological status presupposes that there are natural sustainable channel design methods available to achieve this objective. Designs that simply aim to maximise habitat diversity will not be sustainable if they disregard natural channel processes. Traditional engineering approaches, rational equations and regime theory, are shown to be limited to designing constrained channels, which indicates that alternatives are required for creating more natural rivers. These alternatives are reviewed and measures are presented that demonstrate how rivers can be restored to provide flood mitigation and, thereby, finance the restoration measures.

CATCHMENT SCALE HABITAT MANAGEMENT IN THE MURRAY BASIN, AUSTRALIA

David Collins (david.r.collins@defra.gsi.gov.uk)

The Murray-Darling Basin covers 14% of Australia and contains the continents two largest rivers. The area is currently experiencing severe drought, and this is putting great strain on wetland ecosystems. The issues around wetland management were explored during a Churchill Travelling Fellowship in July 2006.

The Murray River forms the border between New South Wales and Victoria for much of its length, finally passing through South Australia before it reaches the sea near Adelaide. The Murray River's water is an important asset in all three states, so management of the water has to be agreed between them. This is achieved through the Murray-Darling Basin Agreement, which was signed in 1987.

The Murray is far from natural - there are four major water storage reservoirs, sixteen weirs, five barrages and many smaller structures along its length. Wetlands along the river are adapted to seasonal flooding and periods of drought that often extend over several years. However, they are all dependent on occasional floods. Natural floods are now rare due to flow control and water use, and the scarce remaining resources need to be used very carefully to maintain as many of the wetlands as possible.

This presentation considers the main issues around water management and maintaining wetlands in the area, including salinity issues and large scale wetland management. It will also consider role of the New South Wales Murray Wetlands Working Group. The objectives of this group, which was established in 1992, are to develop a strategic approach to the management and rehabilitation of wetlands throughout the Murray and lower Darling catchments within New South Wales, and implement wetland management programmes at selected wetlands. This will be explored through examination of case studies where environmental water allocations have been used.

THE RIVER WENSUM SSSI RESTORATION STRATEGY

Tony Green[1] (tony.green@jbaconsulting.co.uk), Anna Curini[1] and Richard Leishman[2]
[1]Jeremy Benn Associates, Crowmarsh Battle Barns, 100 Preston Crowmarsh, Wallingford, Oxfordshire, OX10 6SL.
[2]Natural England, 60 Bracondale, Norwich, Norfolk, NR1 2BE.

The paper will describe how Natural England, working with the Environment Agency, the King's Lynn Internal Drainage Board and consultants JBA have prepared a river restoration strategy for 71km of the upper River Wensum in Norfolk. The River Wensum upstream of Norwich is a 'whole river Site of Special Scientific Interest' selected for being one of the best examples of an 'enriched calcareous lowland river'. Whilst the Wensum is of rich ecological and cultural value, the features of interest of the River Wensum SSSI are regarded as being in an 'unfavourable condition'.

The Government has set a Public Service Agreement (PSA) target to attain 95% of SSSIs in favourable (or unfavourable recovering) condition by 2010. The Wensum Restoration Strategy is one vehicle being used to deliver the PSA target and the objectives of the strategy have been developed in parallel with the objectives of many complementary schemes and plans in the catchment, including the Catchment Sensitive Farming initiative, the Water Level Management Plan, Fisheries Action Plan and Catchment Flood Management Plan. One of the challenges of the strategy is to closely link with these and other local initiatives as well as other flood related and water management works on the river. The strategy also informs and fits with likely requirements for hydromorphology under the Water Framework Directive.

The objective of the Wensum Restoration Strategy is to restore as much geomorphological function and process to the river as possible within current constraints and to develop a self-sustaining river system with minimal management requirements. This is expected to provide the conditions necessary for chalk river habitats and characteristic species to flourish and for assisted recovery of semi-natural conditions to take place where possible. The existence of the strategy will enable a more integrated approach to future management of the River Wensum catchment as a whole, rather than the current ad hoc, reach-scale approach to river restoration and habitat rehabilitation.

The strategy builds on a comprehensive fluvial audit and pinpoints the main issues that limit the function of natural process in the Wensum catchment. A key issue is that related to water mills and their associated influence on channel form, flow and sediment transport. The strategy identified that 67% of the River Wensum SSSI is affected by backwater conditions and 60% of head losses occur at mill structures. Mill structures represent barriers to fish passage and act as silt traps that present hostile environments for many characteristic species of the chalk river type. Other issues dealt with by the strategy include the overly wide and deep channel dimensions, the loss of relic gravel bed habitats and the lack of river-floodplain connectivity. How the strategy is implemented will greatly influence feasibility and a staged costed timeline of works is considered. Local initiatives, cooperation of stakeholders and partners are critical to implement the strategy and this is being carefully approached.

The Wensum Restoration Strategy is presented as a series of summary tables and maps describing reach-scale issues and recommendations that, when presented together, form a whole river vision for catchment restoration. Separate tables are presented for each of the mill structures as the lowering of operating levels, removal or by-passing of structures must be a priority consideration due to their current impact on the movement of silt and natural functioning of river. The strategy provides practical restoration options covering both the short and longer terms, and it presents a summary of restoration techniques that are suitable for the chalk river type within a supporting technical report.

CHANNEL PERFORMANCE ASSESSMENT AS A MEANS OF DELIVERING FLOOD RISK MANAGEMENT AND WATER FRAMEWORK DIRECTIVE OBJECTIVES

Roger Bettess[1] (roger@hrwallingford.co.uk), Mervyn Bramley[2], Caroline McGahey[1], Jonathan Simm[1] and Michael Wallis[1]
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[2]External Advisor, DEFRA/EA Flood Risk Science

Within the Environment Agency the Flood Risk Management function is implementing a performance-based approach to asset management. It is extending its former asset-based approach to cover overall asset systems. This includes introducing performance specifications and bringing channel into asset management. Under this approach the Target Performance Standard of watercourses will be specified taking into account the potential risk of flooding. A new procedure for performance specification and assessment has been developed with assistance of the Defra / EA Science Programme.

Target Performance Standard will be expressed either in terms of a Channel Condition Grade or in terms of a required conveyance or cross-sectional area for a specified water level. The procedure (which has been developed under the PAMS project) will also aid in the identification of opportunities for modifying maintenance regimes to achieve environmental benefits and in particular to deliver Water Framework Directive objectives. An integral part of the approach is the accurate assessment of conveyance taking into account the nature of the watercourse, drain or river channel and its management. This can be achieved by the application of a range of readily-available, numerical models, including the recently developed Conveyance Estimation System (CES; see www.river-conveyance.net).

The CES is a computer-based tool that estimates the conveyance or discharge capacity of a channel. It takes account of cross-section shape, plan form sinuosity, channel morphology and hydraulic roughness to determine the site-specific stage-discharge relationship. The key components include a 'Roughness Advisor', which provides advice on the hydraulic roughness of vegetation, bed, banks and sediments; a 'Conveyance Generator', which determines the channel capacity based on both this roughness and the channel morphology; and an 'Uncertainty Estimator' which provides some indication of the uncertainty associated with the conveyance estimate. The CES has a further module for calculating backwater curves in reaches upstream of a control point i.e. a cross-section where the flow and/or depth are known. This is particularly useful for exploring the effects of channel blockage

The CES can be used to assess the impact on the conveyance of different management strategies – in particular vegetation cutting and sediment removal. It can thus provide information on how the flood conveyance capacity required for flood risk management can be achieved while ensuring that Water Framework Objectives are met.

DELIVERING WFD OBJECTIVES - MAKING THE LEAP FROM JARGON TO ACTION

Stuart Greig[1] & Richard Jeffries[2]
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[2] Richard.Jeffries@SEPA.org.uk - Ecology and Hydromorphology, SEPA

Good ecological status, ecological potential, alternative objectives, RBMPs, HMWBs. With all the jargon associated with the WFD, it's easy to forget what the Directive's really about - *an agenda to improve the ecological quality of our waters in a way that balances achievement of environmental targets with the needs of other water users and society in general.*

Taking a step back from the jargon, the real question is - how will this agenda be delivered?

In Scotland, SEPA estimate that morphological alterations are adversely affecting around 3,000 km of river. It is immediately obvious that using hands-on river restoration techniques to restore this amount of river by 2015 would quickly become prohibitively expensive. We need a new and more achievable approach and, fortunately, the WFD points the way.

When identifying improvements, the WFD provides two areas of flexibility to ensure that an economically and technically viable approach can be adopted: extending deadlines and using less stringent objectives. These must be set with due consideration of:

- Technical feasibility
- Natural recovery times
- Economic feasibility
- The needs of other water users/uses
- Other Directives, such as the Floods Directive or Habitat Directive

These concepts provide a pragmatic platform for developing a long-term and sustainable approach to improving the quality of our rivers.

In recognition of these principles, and drawing from specific examples in Scotland, this presentation will discuss realistic and achievable methods of delivering remedial measures at a national scale. The presentation will provide examples of catchment planning considerations and tools, and information on the suite of instruments that will be used to deliver improvements to the quality of Scotland's rivers.

FLOODPLAIN CREATION THROUGH EXCAVATION: AGGREGATE EXTRACTION, FLOOD PROTECTION, AND HABITAT CREATION IN THE PACIFIC NORTHWEST REGION OF THE U.S.

Dr. Janine Castro (Janine_M_Castro@fws.gov), Geomorphologist, River Restoration Northwest and Portland State University, Portland, Oregon, USA.

Many streams in the western U.S. are incised due to dredging for navigation, aggregate extraction, channelisation, large wood removal, and disconnection of side channels. In many instances, reconnection of these incised channels to their historic floodplains to improve aquatic and riparian habitat is not feasible because of development that has occurred post-incision. Hence, flooding of infrastructure is a primary limiting factor for habitat restoration along many larger rivers. In this scenario, there is a tremendous opportunity to reduce flooding, provide a source of aggregate, and create aquatic and riparian habitat.

On the west coast of the United States, instream gravel mining continues to be used as an inexpensive source of construction aggregate. With declining fish populations and concerns about channel stability and water quality, instream gravel mining is on the decline due to regulatory constraints. Because of legacy mining in rivers, aggregate extraction and stream restoration are often perceived to be mutually exclusive; however, careful planning, design, and implementation of a reclamation plan can allow restoration activities to occur almost concurrently with gravel mining operations.

The Willamette River in western Oregon has been a primary transportation conduit for products in the Willamette Valley since the 1800's. The channel of the Willamette River is composed of gravel and sand, and has been utilized for many years for its easily accessible supply of aggregate. Instream mining of exposed channel bars and adjacent floodplain pits are common along the lower 100 miles of the river. However, as instream mining continues to decrease, companies are seeking new ways to extract aggregate that are economically feasible, ecologically sustainable, and address societal issues such as flooding. One such project has been developed and another is proposed along the lower Willamette River.

The Willamette River projects involve locating shallow gravel deposits of adequate quality and extent in areas adjacent to the river. The mining plans generally include removal and storage of topsoil, excavation of the aggregate in isolated cells, grading of the mined areas to an appropriate configuration, connection to the river through side channels, and reestablishment of topsoil and vegetation. Key factors include: (1) maximum depth of excavation not exceeding the thalweg depth thus minimizing additional incision due to channel avulsion, (2) utilizing wet mining techniques so that shallow groundwater and hyporheic flows are minimally impacted, and (3) grading to establish variability in depth to maximize potential habitat types and increase edge habitat. On-going concerns include increased water temperature due to thermal exposure, warm water invasive fish preying upon native coldwater fish species, fish entrapment, and channel avulsion resulting in increased channel width. As such, these projects are still considered experimental.

SPACE FOR RIVERS: THE DUTCH APPROACH TO FLOOD RISK MANAGEMENT, FROM POLICY TO IMPLEMENTATION

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Cor Beekmans, Rijkswaterstaat, Ruimte voor de Rivieren, Arnhem, the Netherlands

Historically, Dutch flood risk management has been practically synonymous with flood defence management. Throughout the last millennium, there has been a continuous cycle of flood events and subsequently raising of defences. During the 1990s, water managers in the Netherlands started to realise that continuing this cycle would not be sustainable. A number of factors played a part in this: the ongoing climate change and land subsidence, the recent completion of a comprehensive defence strengthening programme combined with expected higher design discharges, and the increasing insight that raising of defences may keep the probability of failure at the same level, but could increase the consequences of failure, including the risk of life. Finally, the main rivers' undefended floodplains offered unique opportunities for habitat development in a densely populated country. In the Dutch physical situation, defences are still required almost everywhere, but the alternative to heightening defences is to increase the space for the rivers by deepening and smoothening the winter bed, or even moving defences away from the river. This concept was gradually also accepted by politicians, and was eventually translated into national policy.

Then came the challenge of implementation. The Dutch Flood Defence Act stipulates that the primary flood defences along the upper parts of the Rhine Branches have to be able to withstand a water level with a 1/1250 per year probability of exceedance. New statistics revealed that the associated Rhine discharge had increased from 15,000 m^3/s to 16,000 m^3/s. A large study was carried out to investigate the possibilities of giving the river so much extra space that the water levels in the new situation at 16,000 m^3/s would not be higher than those in the existing situation at 15,000 m^3/s. This study has resulted in an overall integrated package of measures that combines redeveloping the undefended flood plains, often in combination with habitat development and other functions, heightening of defences where this was still required and even large scale relocation of defences including removal of existing houses and redevelopment of complete polders. The string of projects to realise these measures is presently starting, with a finalisation date of 2015.

The presentation will illustrate how the Dutch perspective on space for the rivers has developed over time and what the particular challenges were to get the new policy implemented. The presentation will put this in perspective by highlighting some of the essential differences and parallels between the Netherlands and the UK.

RESTORED FLOODPLAIN WOODLAND ON THE RIVER LAVER, NORTH YORKSHIRE: A BENEFIT OR DRAWBACK TO FLOODING IN RIPON

P. A. Xavier [1] (xavierpa@cardiff.ac.uk), Catherine Wilson[1], Huw Thomas[2] and Tom Nisbet[2]
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Small-scale floodplain woodlands can offer relatively significant hydraulic resistance to the propagation of flood waves along a catchment. Such resistance could be used to promote online storage of excess floodwaters upstream of areas at risk of flooding. In the UK & Europe there are many excellent examples of sites where planted forests are seen as potentially beneficial to regional flood risk management plans. Further studies are required in this area, as little is still known about the specific hydrodynamic effects of European forest vegetation and the impact of planted forests on main channel velocities.

The research undertaken at Cardiff University is looking into vegetation-flow interactions, with a particular emphasis on common floodplain woodland species. Along with results from other researchers in the area of vegetated flows, the results will be used to develop a transferable numerical model for the study of the hydraulics of floodplain woodland and densely vegetated floodplains, to assess the potential flood alleviation benefits of both existing and proposed floodplain woodland sites.

An initial scoping study using the 1D modelling package ISIS has indicated that there is a tangible delay and diffusion in the flood hydrograph when roughness values equivalent to floodplain woodland are used in patches upstream of an area at risk of flooding. The key limitation of the 1D approach is the lack of representation of physical floodplain properties such as the often complex overland flow paths of floodplain flows due to local topography and the heterogeneous nature of vegetation and debris. 2D numerical modelling offers a more realistic representation of the hydraulic impact of floodplain woodland. DIVAST, an existing 2D depth-averaged, finite difference numerical model, is currently being enhanced with resistance coefficients developed specifically for floodplain woodland, obtained from experimental studies and field data. The model would take account of the type and density of woodland, and be capable of determining the planting regime that would maximise floodwater retention. Hydrological & topographical field data, currently being gathered from UK and European sites including a proposed woodland site at Ripon in Yorkshire and the Wienfluss study site near Vienna will be used to calibrate and refine the modelling tool.

Controlled relevant experimental studies are undertaken in the Hyder Hydraulics Laboratory at Cardiff University. The data acquired will be used to investigate further the governing flow processes and determine parameters for use in the refinement of the numerical model. The experimental plan includes investigating the flow interactions with both simulated and real vegetation.

In due course the modelling work may be extended to include water quality and the dispersion of pollutants, sediment transport in overbank flow and groundwater/flooding interactions through the 1-D/2-D groundwater and channelised ditch extensions currently being undertaken by the Cardiff Research team through the Flood Risk Management Research Consortium studies.

MAKING THE MOST OF THE EXECUTION PHASE OF A RIVER RESTORATION PROJECT IN NORTH EAST SCOTLAND

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There are arguably three phases to good river restoration; appropriate investigation and design (before), good execution (during), and necessary aftercare / monitoring (after). Conference papers often tend to be biased towards analysis of issues and subsequent design. In this paper we look at the execution phase of the restoration of 1.7 km of new river channel, and the rehabilitation of another 0.7 km as part of a more extensive water quality and flood management project in north east Scotland in 2006.

A good design gives the project a sound footing; but there can be few plans which do not need some amendment on the hoof, and every project can be polished in it's execution if the site managers and the contractor are alert to opportunity and interested in the long term outcome. Because this project was extremely ambitious in it's scope, and highly constrained by wildlife considerations, all the typical problems encountered in a large project were compacted into one 10 week period, and every issue needed an answer straight away. This could have led to a confrontational relationship, but in fact focussed a lot of energy into a constructive and co-operative approach.

In this presentation we look at some of the practical issues that arose, and explain how we achieved a notably positive restoration.

WFD AND NATURA: RESTORING A DESIGNATED SITE TO BENEFIT BIODIVERSITY AND DELIVER IMPROVED WATER LEVEL MANAGEMENT.

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The Loch of Strathbeg is a SSSI, SPA and Ramsar site in Northeast Scotland. Protected primarily for its pink-footed goose wintering population (peaking at 20% of the world population) it also hosts nationally and internationally important wintering populations of other wildfowl species, and a diverse range of designated wetland habitats. The RSPB manages over 800 ha of land, spanning a large proportion of the designated area, as well as neighbouring farmland managed for farmland birds and wintering geese. The first round of Site Condition Monitoring completed by SNH reported the Loch of Strathbeg to be in Unfavourable Declining condition for 14 of the 27 reported features, including all four habitats (fen meadow, transition fen, eutrophic loch and sand dunes), and 7 out of 12 bird features (sandwich tern, pochard, tufted duck, teal, mute swan, greylag goose and goosander). The loch has also been identified by SEPA as at high risk of failing to meet WFD standards and under pressure from diffuse agricultural nutrient enrichment & siltation.

An ambitious restoration programme was commenced in April 2006 that aimed to return the fen habitats to Favourable Condition, and to re-naturalise the Savoch Burn, the main inflow to the loch. The Savoch Burn restoration was designed with two aims: 1) to reduce the amount of silt and agricultural nutrients entering the loch and improve water level management in the floodplain, and 2) to provide improved habitat for key biodiversity (reedbed bird species, water voles & wet grassland bird species). Achieving a balance between these two, sometimes conflicting aims, has required a painstaking project design and lessons learned from the process will be discussed.

THE INFLUENCE OF THE C.A.R. REGULATIONS ON RIVER ENGINEERING PROPOSALS: RECENT EXPERIENCES

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The 'Controlled Activity (Scotland) Regulations 2005' came into force in Scotland on the 1st of April 2006, following a 6 month transition period. Drawing on the principles of the European Water Framework Directive, the Regulations add new legislative controls on any proposed works undertaken in the proximity of most freshwater watercourses in Scotland. These principles are a radical departure from traditional methods of measuring and conserving the quality of the aquatic environment using only chemical parameters. The new regulations adopt a broader perspective to assess and conserve the status of a watercourse using a range of parameters including chemical, physical, hydrological, morphological and biological to give a holistic picture of aquatic ecological health.

This move has necessitated a change in the level of environmental assessment routinely undertaken for proposed developments. Morphology is now a key component of a baseline assessment even for smaller, non-designated watercourses.

This paper will present two examples of watercourses which will be affected by the Aberdeen Western Peripheral Route; a 46 km dual carriageway project. Red Moss Burn is a highly modified, overdeepened and straightened field ditch while Kingcausie Burn is a gravel bed stream which is currently re-naturalising following previous modification. Both watercourses are upstream of designated water bodies but are not actually designated themselves. Red Moss Burn feeds Corby and Lily Loch SSSI, while Kingcausie Burn is a rural tributary of the Crynoch Burn, part of the River Dee SAC. The proposed modifications range from road drainage outfalls, culverting and realignment to the provision of engineered cascades.

Through the development of draft CAR applications, Proposals for these watercourses are being developed at the outline design stage and incorporate a greater level of environmental mitigation measures than would have been considered necessary in the past. Where appropriate, the design processes has considered opportunities for morphological improvement of these watercourses which edges towards restoration in a way that supports the principles of the Water Framework Directive.

RIVER SEDIMEMNT AND HABITATS AND THE IMPACT OF CAPITAL WORKS AND MAINTENANCE

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HR Wallingford is leading this 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 that is effective, minimises the adverse impacts on the environment and potentially brings benefits for the sediments and habitat characteristic of a river. 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, with an ongoing programme of data collection. Some preliminary conclusions have been found in relation to each case study as follows:

- Gravel removal on the River Kent in Cumbria is carried out due to the perceived potential impact on flood risk. The invertebrate survey has already suggested that the recovery of the invertebrate population is rapid following maintenance.
- Making changes to the weed cutting programme on the Long Eau in Lincolnshire, is not sufficient to create a self-cleansing river channel. Allowing areas of sediment to develop habitat is also necessary. It would also appear that the artificial riffles that have been introduced are not having the originally intended impact.
- The narrowed reach of the River Dearne in South Yorkshire is acting satisfactorily from the point of minimising the requirement for sediment maintenance but is not generating sediment related habitats.
- The River Harbourne in Devon, is an example of how the conveyance of a channel could be increased but the channel itself would be self-regulatory. The evidence to date suggests that to a large extent this has been achieved. The incidence of flooding has been reduced and local deposition in some areas has been observed as expected and sediment related maintenance will have to be carried out in the future..
- Weed cutting and sediment removal is carried out on The River Eden in Kent. The periodic removal of sediment from the bed lowers water levels locally and results in bank-side ledges being too high to provide habitat for wetland plants and also inhibits processes of morphological evolution. A lower frequency of maintenance might allow a greater degree of morphological diversity to develop.

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.

ST. JOHNS BECK, UK, CUMBRIA: A HEAVILY MODIFIED STREAM, BUT AT WHAT PRICE RESTORATION?

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The watercourse of St Johns Beck flows from Thirlmere to the Glendermackin and is a classic Lake District modified watercourse, with a straightened planform and high embankments, consisting largely of rip-rap and blockstone. It is also a SAC and SSSI, designated for its salmonid, lamprey and otters, its water crowfoot and plantain fauna, and its substrate habitat. The land-use in the valley is intensive grazing and grassland.

The channel straightening and modifications have produced a higher gradient and a constrained planform; the former gives greater stream power and ability to erode and transport, the latter gives little opportunity for stable sediment deposition. The result is a high energy, highly unstable system that under high flows leads to dramatic attempts to impose a sinuous meandering planform on its current lateral constraints. Conversely, the confinement to a single channel maintains good flows year round, and with sediment input from key tributaries the bed morphology is currently good, with many spawning riffles along the reach in question.

A key decision for future management concerns maintenance of the embankments. Under high flows the river is eroding its embankments. If allowed to erode through, the out flanked rip-rap and stone work would in itself become a destabilising factor in the rivers natural rehabilitation and the on-going adjustment would result in an extremely unstable planform for the conceivable short term (of at least 30 -50 years).

The rip-rap and blockstone bank protection are dramatically oversized compared to the rivers natural sediment regime in the valley and would never be ‘sorted’ by the river flows. They would remain as isolated fixed points, causing additional localised scour problems and preventing the river from adjusting to a more natural planform. Under such a scenario, the impacts upon the SAC designated species relating to the current bed morphology would require careful consideration.

If the embankments are not to be maintained, the only real alternative is to go for river restoration. Half measures, involving leaving the river to erode the blockwork, would result in serious disruption. The restoration would have to include full removal of the embankments and reinstatement back to a more stable meandering planform. Setting back embankments may be a consideration, but would also require removal of the heavy, artificial bank protection if it is not to destabilise natural readjustment. Benchmark costs for full river restoration are in the order of 1 to 2 Million pounds sterling for this 3.5 km stretch (based on costs from recent full restoration projects).

A LONG-TERM STRATERGY FOR FISHERIES FUNDED PROJECTS IN THAMES REGION

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Projects are often limited by the funds available therefore it is important to prioritise work that delivers the most benefits. This poster briefly describes how funds are allocated to Environment Agency led fisheries projects in Thames Region, using a nationally developed fisheries project prioritisation tool in combination with local issue-driven targets.

Projects are scored using the prioritisation tool which includes criteria derived from our National Fisheries strategy, as well as related drivers such as the Water Framework Directive, and a range of basic principles that should apply to any good project, for example having clearly defined and measurable objectives, baseline information and an appropriate monitoring program. Local issues and related targets also play an important role in determining the allocation of funds. These are described within the recently published 'Our plan for Fisheries in Thames Region 2006-2001, a bright future for our fish'. As a result a structured, but flexible program of work has been developed using this approach, whereby well conceived projects that contribute to a range of objectives are more likely to receive funds. A flexible approach is important so that opportunities that arise at short notice can be considered.

INTEGRATED LAND AND WATER MANAGEMENT IN FLOODPLAINS: REVISITING AGRICULTURAL FLOOD DEFENCE SCHEMES IN ENGLAND AND WALES

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Agricultural Flood Defence Schemes in floodplain and coastal areas were once an important element of Government support for farmers in Britain. More recently, however, concern about environmental quality and perceptions of increased flood risk in lowland areas have promoted a re-appraisal of land management options and policies for floodplain areas. This reappraisal has also been driven by EU Environmental Directives and Reform of the Common Agricultural Policy, as well as longer term issues such as climate change.

Eight agricultural flood defence schemes, previously studied by the research team in the 1980s, are being reviewed to determine changes in land and water management that have occurred over a 40-year period. Stakeholder and institutional analysis, farmer interviews, field observations and modelling of hydrological and related ecological processes are helping to identify factors associated with and/or responsible for these changes. The extent to which changing agricultural policy has been important, interacting with farmer circumstances and motivation, is also being explored. By combining the perspectives of social, natural and physical sciences, the consequences for farm livelihoods, nature conservation, and the management of flood risk are being assessed, helping to inform policy and practice for floodplain management, hopefully in ways that will appeal to the key stakeholders.

The research involves farm survey and analysis of farmer decisions; institutional analysis and stakeholder mapping; assessment of flooding and water level regimes and of biodiversity and conservation.

Common patterns in management practices will be explored between sites, helping to determine whether generic management guidelines hold true for single land and water management objectives across most sites. Scenario analysis will further aid our appreciation of the feasibility to simultaneously achieve multiple floodplain management objectives.

MEASURING AN ECOLOGICAL RESPONSE TO RESTORATION OF FLOODPLAIN FOREST

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A LIFE 3-Nature partnership[1] project to restore floodplain forest habitat and degraded streams, within the New Forest in Hampshire, has recently been completed. As part of this project, the Environment Agency is monitoring resulting changes to the in-stream biological communities.

The ecological benefits of river or flood plain restoration work are very often the grounds on which the investment is justified, and it is essential to try and quantify changes in community structure that result. Few aspects of riverine ecology are as well understood (and comprehensively studied) as the macro-invertebrate community, and multivariate analysis enables an objective assessment of these communities.

Subtle but significant differences were detected between invertebrate communities of degraded, channelised reaches, and those found in reference, sinuous reaches of the same river and locality. These differences - generally elevated or reduced numbers of certain key species - have highlighted the importance of various elements of the physical habitat, and have the potential to be useful indicators of riparian habitat condition. Post-restoration monitoring of restored reaches, in parallel with the original control reaches, has informed our understanding of the extent of ecological disturbance that results from channel restoration. Community difference decreases over time as 'new' physical habitat becomes stable, and ultimately offers the same biotic and abiotic conditions present in reference reaches.

Fish surveys have also been carried out in order to allow comparison between the channelised and natural reaches. This will provide a measure of how this type of habitat restoration affects both the spatial distribution and abundance of species of key importance, such as lamprey and bullhead.

Further details on the partnership project can be found at www.newforestlife.org.uk.

[1] Environment Agency, English Nature, Forestry Commission, Hampshire County Council, National Trust, Royal Society for the Protection of Birds

URBAN RIVER RESTORATION PROGRAMME

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In Hampshire and the Isle of Wight's more urban environments, there are stretches of river that have been heavily modified to meet the water management requirements of industry and flood defence for human benefit. This work has often resulted in increased risk of flooding, and a deprived environment for both people and wildlife.

Flood risk management solutions have typically involved "hard" engineering options, but now the move is towards seeking "softer" alternatives which include modifications to structures; the development of fluvial and tidal flood modelling; future consideration of flood storage within the catchment (for example, in upstream woodlands), and channel enhancements.

The Urban River Restoration Programme incorporates a number of discrete river restoration projects. Most of these will be dealt with through a co-ordinated flagship partnership. That way, efforts can be better co-ordinated to give better value and better results to the people and wildlife that use the catchment. Restoration of selected urban rivers will offer not only the necessary protection to homes against flooding, but an enhanced environment for people and wildlife.

A high quality environment can directly improve the health and wellbeing of surrounding local communities. As part of this work, it is vital to engage with local communities, businesses and schools, and encourage their participation in all aspects of the project. When deciding which other stretches will be restored by the programme, a key deciding factor will be the support for the project from the local community. The Environment Agency is aiming to help find sustainable solutions to flood management issues by working with communities and giving them areas which they will cherish and care for in future years.

A METHOD FOR PRIORITISING THE APPRAISAL OF RIVER RESTORATION SCHEMES

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Monitoring is an important aspect of any procedure that seeks to determine whether a technique has worked effectively. The river restoration process is no different. Unfortunately, monitoring is often not undertaken due to constraints on time and resources, as well as the commonly held belief that river restoration is inherently a good thing and as a result monitoring is unnecessary. However, there are many reasons to monitor projects and amongst the most important is the need to learn from experiences and for regulatory compliance.

With limited resources it is important that effort is targeted where it will produce the most beneficial information. Monitoring a few schemes well is better than trying to monitor all schemes and compromising scientific standards. To enable this more strategic approach a method has been developed to ensure that limited resources can be targeted to where there is the most environmental risk and potential to learn.

INTEGRATING GEOMORPHOLOGICAL PRINCIPALS AND ENGINEERING DESIGN TO PROVIDE SUSTAINABLE AND PRACTICAL SOLUTIONS FOR FLOOD RISK MANAGEMENT

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Geomorphology and River Engineering both play an integral role in the design of sustainable and practical solutions for flood risk management. A detailed assessment of the geomorphology of a river system, through both field and desk-based investigations, can be determined by identifying key patterns and processes that control the spacing and nature of existing morphological features. This understanding of the system can be inputted into the engineering design process at key stages providing the opportunity to incorporate innovative solutions. Through the utilisation of geomorphology within design there are greater opportunities for schemes to be more sustainable, incorporating aspects that improve environmental aspects and ecological habitats.

This poster will highlight two key case studies where geomorphology has been linked with river engineering in design to help sustain reduced flood risk whilst promoting improvement to geomorphology and ecological habitat. Recommendations will be made in terms of how to add value to projects by improving habitats through innovative engineering solutions based on an understanding of the key geomorphological features and processes within the system. These case studies are on Dartford Creek, Kent and the Afon Brennig, Mid Wales. Both sites are very different in terms of their river type, the reasons and nature of work and the basis for design. Ultimately, key findings and recommendations will be described highlighting a range of approaches to system-specific engineering design.

FLOOD ALLEVIATION AND OPPORTUNITIES FOR HABITAT CREATION AND ENHANCEMENT.

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Sacha Rogers (sacha.rogers@pennyanderson.com) Principal Ecologist
Chris Chapman (chris.chapman@pennyanderson.com) GIS Consultant

The poster will illustrate proposals to redevelop a large disused industrial site in Greater Manchester for mixed commercial and residential use. It includes the construction of a 25m wide flood berm designed to accommodate a 100 year flood event. The site extends along the inside of a meander loop of the River Irwell and is similar to many urban riverside re-development settings that look to conform to Planning Policy Statement 25.

Historically, the long industrial legacy of the River Irwell has meant that the water quality has been poor. The General Quality Assessment shows that nitrate levels are moderately low but high levels of phosphates and high Biological Oxygen Demand (BOD) suggest that the general water quality is still poor today. However, over recent years there has been an improvement in the water quality and in 2004 it was compliant with the River Ecosystem Classification target grade of 3. This suggests that the water quality is of 'fair quality' and suitable for sustaining high class coarse fishing.

The proposed flood berm will experience periodic inundation but for much of the year it will be dry. This presents an opportunity to create 2.17ha of new ponds, wetlands and grassland, and a resource for informal public recreation. One element of the scheme is the establishment of a series of discrete and inter-linked ponds and wetland depressions on the flood berm. They will be sustained by groundwater and augmented by rainwater harvested from the adjacent residential and industrial areas. Backwater channels would also be created to provide refuges for fish.

The seeding and planting regime will comprise selected native plant species and minor modifications to the river's edge will be made to create small niches of contrasting habitat as feeding areas for wetland birds and for river invertebrates. This will be achieved by scalloping the banks, forming small bank terraces, marginal berms and introducing localised variations in water depth. The floodplain habitats would be managed by occasional mowing and scrub clearance, and infrequent de-silting of the pond and backwaters.

The scheme will form part of the drive to restore the Irwell corridor, which is recognised as an important green corridor in the Wildlife Strategy of the local authority, providing ecological connectivity between areas of wildlife value and acting as an important route for the migration, dispersal and genetic exchange of wild species. It aims to create a diverse habitat that avoids the sterile appearance sometimes associated with flood alleviation schemes yet not compromise the floodwater conveyance capacity of the new channel.

MEASURING, MONITORING AND UNDERSTANDING RESTORATION GEOMORPHOLOGY USING TERRESTRIAL LIDAR

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Effective monitoring of implemented river restoration schemes is critical if their effects on the river system are to be understood and the works themselves are to be maintained. Typically, schemes are monitored using walk-over surveys, photographic evidence and conventional survey tools such as Electronic Distance Measurement (EDM) thodolites, global positioning systems (GPS) and photogrammettry. Large-scale schemes can be measured using airborne light detection and ranging (lidar) methods, however the resultant data often suffer from perspective, resolution and accuracy inadequacies. The relatively low-resolution and inherent error of this data means that coordinate datasets are not suitable to represent the unit-scale features that are typically implemented with the aim of creating a healthier river environment.

Recent developments in terrestrial lidar survey equipment and techniques mean that the river environment is now measurable to a level of detail that accurately represents it's complexity over many scales. Long-range terrestrial laser scanners can have a measurement range of up to 1500m and have a point accuracy of less that 0.01m. The coordinate data set that results from a terrestrial lidar multiple-scan survey can have such a high point resolution that the need for interpolation is negated, thus removing the influence of interpolation error. Measurement in this way means that individual restoration features such as deflectors, gabions, and willow hurdles and faggots can be digitally represented in detail. This is also the case for the general river morphology, which can be measured down to the grain-scale in exposed areas. Repeat multiple-scan surveys and digital terrain model (DEM) subtraction can elucidate extremely detailed spatial change information relating to geomorphological change and/or scheme deformation.

Dartford Creek is a tidally-influenced, environmentally-sensitive estuary in Kent and it is currently undergoing engineering works to renforce some local flood protection measures. A scheme has been sedigned to lower the gradient of the river banks in the channel near where they are in close proximity to flood embankments in order to reduce local erosion. This is being done by laying brushwood mattresses in key areas in order to promote local siltation and gradient reduction and will work in combination with sheet piling to maintain the geotechnical integrity of the embankments. This paper reports on how terrestrial lidar has been used to measure, understand and monitor this site.

RIVER RESTORATION IN A HIGH CULTIVATED CATCHMENT: FINDING THE BALANCE BETWEEN ECOLOGICAL / HYDROMORPHOLOGICAL NEEDS AND PUBLIC SUPPORT: A BELGIAN CASE STUDY

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Project of the Flemish Water Authority (VMM-afdeling Water), developed by Haskoning Belgium

The Flemish Water Authority intends to restore a 3 km segment of the Poperingevaart in West-Flanders. The main land use in the river catchment is arable farming industry, where a combination of loamy textured, erosion-prone topsoil, moderate slopes and a straight river planform, induces high water discharge peaks. The deeply incised river bed is very prone to further fluvial attack due to the steep gradient and erosion prone soils, causing extensive river planform shifting across the floodplain.

The displeased farmers want a pragmatic erosion protection, focused on river bank protection. The Flemish Water Authority wants to reach the Ecological Quality Objectives defined by the European Water Framework Directive. This asks for a more sustainable approach derived from sound principles of hydromorphology. Instead of refurbishing the bank revetments to suppress the river dynamics, the Authority wants to use and cooperate with the natural processes. To create space for the natural developments of the river course the Government is now acquiring both river banks: a costly and time-consuming procedure. Royal Haskoning has traced out the design of the acquired river banks in order to reach the following objectives:

- durable erosion-protection of private property;
- hydromorphological improvement of the involved reaches;
- ecological improvement of river bed and banks;
- increased potential of flood prevention in the city of Poperinge;
- construction of 2 fish passes: one along a medieval weir, one over a German WWI flow regulation structure;
- water quality improvement through adaptation of the sewage system;
- construction of a walkway along the river restoration project for a better landscape perception.

As a result of the diverse constraints imposed by a manifold of involved parties (Flemish Water Authority, farmers, City Council of Poperinge, Flemish Environmental Authority, Flemish Heritage Authority), the project has only been able to partly release the river. Currently, there is no public support for a complete natural course of the river Poperingevaart throughout the project area. The land strip along the river course that is now being acquired varies between 15 m (50 ft) and 30 m (100 ft).

The City Council stipulates the integration of some soft recreation. Along the 3 km (1.8 mile) project stretch a walkway will be constructed. Bank and bed protection will only be removed in restricted restoration zones. Spur dikes will be installed to increase the water velocity diversity. Steep banks will be smoothened from a slope of 1/1 to 1/2. Along the right bank a hedgerow will be planted with indigenous woody species. This will create a visual barrier and an ecological corridor for fauna in the agricultural desert. The left bank contains the walkway and some sparse shrubbery. In the widest stretches of the project zone the river banks will be relocated several meters backwards and above the level of a discharge with two-year return period. This will increase the water carrying capacity of the river bed. The wider stretch also contains some German WWI bomb shelters and a former WWI flow regulation device. They will be highlighted along the walkway, although the German flood control dam will partly be removed. To decrease the historical incision level of the river bed, stones recovered from the riprap revetment will be placed in the river course. A fish passage is planned at the site of an ancient weir, which is in fact a dilapidated brick construction. A complicated design meets the demands of the Heritage Authority. The design preserves the weir, preserves the actual water level at the weir and deals with the lack of space on the spot.

Through intensive and time-consuming communication with the different parties, a final design was elaborated that received general support. The realisation of the different measures of this complicated project are foreseen in the spring of 2008.

RIVER RESTORATION IN ITALY. GUIDELINES, TOOLS & EXPERIENCES FOR THE MANAGEMENT OF RIVERS & TERRITORY

Andrea Nardini (info@cirf.org) and G. Sansoni (CIRF), Mazzanti Editori, Mestre, 2006.

The thousand questions on river management

How can we face the increasing flood risk? Does flood risk reduction necessarily imply sacrificing the river ecosystem? Is it possible to aim at the latter in order to also get more safety from floods? Is the policy of making the territory safe from floods with high recurrence time effective, or can it even lead to a risk increment? How much do flood protection works cost? Can we sustain the increasing flow of building and maintenance costs? Are we sure that protecting river banks from erosion is always profitable? Why is more and more time spent on protection works, yet flood peaks and damages keep increasing? Is riparian vegetation a risk or a safety factor? Should we keep riverbeds "clean" (no sediments, no vegetation) and hydraulically efficient (regular sections and straight profiles)? Do we really want more protection works or rather a different and more effective strategy exists? Can we afford to give more space back to the rivers? How can we "live together with the risk"? Is it possible to combine flood protection with strategies to reduce summer water crises? Why, despite having built tens of thousands of treatment plants are our rivers are still polluted? Is it possible to incorporate constructed wetlands and buffer zones into traditional water treatment facilities in order to improve water quality? Is it possible to find out synergies between interventions for floods risk reduction and achievement of the water quality targets fixed by the Water Framework Directive (2000/60/CE)? How can we address conflicting objectives to achieve consensus and effective decisions?

An innovative manual

La riqualificazione fluviale in Italia is a real "manual", but it focuses on strategies instead of techniques (techniques are not ignored, but specified from the former). Rather than describing constructive details of physical interventions, the whole project process is addressed, in order to guide the reader to find out the best strategies to be adopted and, before that, to clarify why something should be done and what is really desired and pursued. But these strategies have to be put into practice and this is why the manual includes *operational guidelines*, starting from planning and managing policies, especially addressing decision making processes with a focus of interest for decision and policy makers (basin authorities, drainage and irrigation authorities, local agencies and authorities) as well as for the technical and scientific world. An integrated technical approach is proposed, structured into different phases and key steps: a revolution in our (Italian) traditional planning method, that can nonetheless be integrated within current administrative structures. The section *guidelines to intervention techniques* starts from the design of the geomorphological set-up of the river and includes, among others, habitat restoration and erosion control techniques. The last section - *case studies* - shows the approach through solution schemes and description of real experiences. But this is not all: the manual is conceived as a *living* one, to be constantly enriched by the latest experiences on new cases and by the outcomes of realised projects (through *on-line updates* on CIRF website).

NEW STREAMS FOR OLD

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The creation of a new watercourse to help mitigate those lost through residential development.

Private speculative residential development generally manages to form one of the annual hot potatoes on a number of fronts. When one developer, seemingly deliberately, destroys an existing watercourse it may be viewed as a crime. When the developer eventually sees common sense and helps restore the balance it becomes less obnoxious and slightly more acceptable, demonstrating that co-operation does pay.

Heatherton Village formed an area of agricultural land adjacent to one of the more attractive areas of the City. The original development plan took no account of any of the existing watercourses and boundary ditches that traversed the area. Substantial houses of 4, 5 and 6 bedrooms were constructed along one of the most important of these boundaries, close to where the watercourses had been severed and effectively removed. Subsequent flooding to these properties prompted angry responses from residents, stimulating some rapid planned coordination between Local Authority and developers. Various meetings took place to determine best approach with the eventual result that a compromise was reached with the eventual restoration of a short portion of the original together with the creation of a new watercourse. The decision was made to incorporate the new watercourse into public open space allocation in order to secure some sort of long tenure for upkeep and maintenance purposes. A combination of open watercourse and piped sections was required in order to meet requirements where it went through infant school premises. Selected species planting took place in specific areas where tree cover was thought to be a long term advantage. One medium and two small ponds were introduced along the length to encourage diversity of colonisation and for short term balancing effect. Inlet and outlet structures were formed using dry concrete filled bags, with trash screen options retained for later use if found necessary.

The original catchment comprised some 85Ha, with the original length of watercourse 1,700m to its outfall into the small main river of Hell Brook. This watercourse in turn was enmained through its dynamic effect on properties through a tendency to overtop in events from 10% upwards. The outfall was frequently drowned so, although some length and area was lost with the reconfiguration it is hoped that little long term environmental damage will be felt. The new catchment is around 40Ha, with the new length being some 1,300m. The initial 650 m falls on the original line with no adjustment to the gradient of 4%. The remaining 650 flattens to a gradient of lightly under 1%.

During the past two years since being re-cut, a variety of species have naturally colonised both banks and bed, where emergent growth of hard & soft rush together with a number of grasses have become established. The banks also hold a variety of species of plants including some wild flower species, grasses and clover. It is hoped that these will gradually increase to extend the ground and bed cover to allow a greater variety of both invertebrate and insect life to appear. The water quality is good although constant flow is not available for the whole length. Altogether the area now is relieved of a flooding problem and the environmental benefits to the community have increased.

RESTORATION OF PICKNALL BROOK, UTTOXETER – BALANCING FLOOD RISK MANAGEMENT & RIVER HABITAT IMPROVEMENTS IN THE CONTEXT OF SITE REDEVELOPMENTS

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As part of the proposed redevelopment of a large area of industrial land located near the centre of Uttoxeter, Weetwood have undertaken a study to examine the potential options for the restoration of Picknall Brook. This includes the management of flood risk associated with the proposed redevelopment of the site. Picknall Brook is designated as a Main River and the proposed restoration has been discussed with all interested parties during the development of the proposals.

The watercourse's channel is currently man made and has been straightened from the original line of the watercourse. Through the modelling of the existing channel it was demonstrated that the site and the surrounding area were at a significant level of risk from flooding. The man made channel and banks of the Brook have resulted in a general absence of a variety of plant life, with the majority of the Brook exhibiting a lack of bankside vegetation as a result of the channel's previous modification. Due to the general absence of plant life it is likely that a diverse and sustainable habitat will never be able to develop along this section of Picknall Brook unless restoration is undertaken.

The restoration options considered for Picknall Brook through the redeveloped site aim to provide a more natural channel, a reduction in the level of flood risk and ecological improvements. Weetwood considered several options to achieve these aims which took into consideration the constraints presented by both the expectations and economic limitations of the relevant stakeholders. This included a 'do nothing' scenario, maintaining the existing channel alignment whilst breaking down the man made channel walls, the introduction of meanders into the existing channel alignment and the realignment of the watercourse along a new route.

As a result of hydraulic modelling of Picknall Brook, the proposed re-alignment and associated channel re-profiling works were shown to not only to provide adequate flood protection to the site but also to decrease flood levels upstream of the site. The restoration options also provide significant ecological and aesthetic benefits when compared to the current configuration of the Brook.

PLANNING FOR WHOLE RIVER RESTORATION PROJECTS: PHYSICAL IMPROVEMENTS ALONGSIDE RIVER STEWARDSHIP

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River Restoration & Enhancement Projects - This project started life as a planning tool looking at whole catchments in order to pick out watercourse enhancement & restoration opportunities. We've completed reports for two catchments in South and West Yorkshire. Rivers are divided into reaches, and a range of restoration projects identified. These have been prioritised in order of potential benefit to the river (in terms of quality and function to benefit ecology and recreational amenity). These are being put into Flood Risk Management Schemes to deliver enhancements and mitigation, and will also feed into the WFD plans. Some of these restoration projects have already been delivered by Flood Risk Management.

Of course, some projects will only happen through opportunities such as planning gain, but we hope that this approach means we can proactively target schemes instead of waiting for them to arrive, and also make the most beneficial projects happen sooner! Documents have been shared with angling clubs, Councils, Rivers Trusts *etc* so all opportunities for partnership delivery can be taken. The study uses high resolution aerial photos alongside GIS based data to look at various features within the boundaries of the river catchments. Project types & opportunities include:

- Angling development opportunities e.g. access improvements
- River Corridor Habitat improvements: bankside, instream, de-culverting & canalisation
- Wetland areas
- Buffer strips in rural and urban areas
- Removal/alteration of in-stream barriers (e.g. weirs & sluices)
- Support Environment Agency work such as flood defence and water resources projects
- Influencing planning gain through strategic and local documents and projects

Influencing others and delivering outcomes - The River Restoration data can also be used to guide the project briefs and strategies of others. Our External Relations team looks for opportunities to promote the project ideas identified within the study to active groups. This is promoted alongside the concept of River Stewardship.

Developing 'River Stewardship' (RS) schemes could offer a capacity for active groups to implement some project ideas. Formal RS schemes forge a crucial link between the active project group, statutory bodies and riparian owners, enabling them to draw on a variety of resources. More importantly, schemes usually involve local residents and community groups in some of the practical aspects of projects. In the long-term RS schemes aim to ensure that people are reconnected to their waterways, and place a greater value on them in the future. Commonly, schemes aim to:

- clean up waterside environments
- improve access for recreation
- carry out maintenance and remove graffiti
- improve wildlife habitats
- encourage pride and ownership within communities

We currently have Calder Futures, West Yorkshire, in place. Groups on the River Sheaf and the Aire through Leeds are close behind!

CHALLENGES AND OPPORTUNITIES FOR RIVER RESTORATION IN A CATCHMENT: THOUGHTS FROM CATCHMENT FLOOD MANAGEMENT PLANS.

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A Catchment Flood Management Plan (CFMP) sets out the high level flood risk management policies for a river catchment. They present a great opportunity to challenge the policies and ideas that have gone before and incorporate the philosophies presented in Making Space for Water and Learning to Live with Rivers. The outputs from CFMPS are high level policies which provide a steer; they do not set out specific scheme level approaches. The challenge is to use CFMPs to guide both strategy and scheme level developments to ensure that river restoration at a catchment scale is considered and implemented.

Using our experiences from preparing several Catchment Flood Management Plans we have gathered our thoughts on how river restoration can be taken forward from the CFMPs. Our views are from the perspectives of Civil Engineers, Environmental Scientists and Geomorphologists covering the breadth of the flood risk management professions.

Focusing on the practicalities of implementation and the limitations of the river management framework within which we operate we have already identified several challenges to river restoration. There is a need to balance the requirements of our civilization for water supply, transport, housing and industry with that of the natural environment. Our aspirations to restore our major rivers back to a natural, diverse and beautiful habitat competes with other drivers including agriculture and development. These mechanisms and catchment issues will be explored further.

The most important section of the CFMP is its Action Plan. This action plan offers opportunities for river manager to highlight the need for further research, to identify joint opportunities for river restoration and flood risk management and to set the agenda for future strategies. In preparing the CFMPs we have a number of ideas on how flood risk management can be delivered sustainably, so that our children inherit a country with an ecologically rich river habitat, a vibrant economy and somewhere to live work and play without fear of climate change. Sustainable and holistic catchment management can be partly delivered through the Water Framework Directive and opportunities for tying into River Basin Management Plans will be highlighted.

THE RESTORATION OF THE MURA RIVER IN SLOVENIA - SCIENTIFIC, TECHNICAL AND LEGAL ASPECTS OF THE IMPLEMENTATION

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Floodplain forests along the Mura River are the most important alluvial forests in Slovenia. There are still semi-natural parts of the Mura River where river dynamics have stimulated the creation of sand dunes, gravel bars, islands and erosion of banks. The old oxbow lakes are well known for their biodiversity values. National authorities have decided that existing natural resources and biodiversity should be conserved and ecological character of the basin to meet the needs of wetland ecology restored. The rehabilitation process of the Mura River in Slovenia is based on five main conceptual lines: a) to achieve and implement ecologically appropriate maintenance practices, b) to design special restoration schemes, c) to strengthen co-ordination between planning organisations at the national and local level, d) to raise public awareness and to seek to involve both the public and NGOs in the decision making process and e) to strengthen international cooperation on water management and wetland protection between Slovenia and neighbouring countries.

The design of restoration schemes is based on the fact that the most apparent consequence of river bed lowering and degradation of wetlands in the region is shown in weakened stream channel morphology. At the times of low and average discharges, water from the channel is not entering into backwater channels. In addition, some of the entrance sections of backwater channels have been artificially filled to prevent regular inundation of river water. Water from the main channel at the Mura River fills the side channels only when a flood wave raises the level at the river above the hydraulic base level. The processes of channel dynamics are therefore limited only to periods at floods. The primary objectives of measures should be to increase the frequency of flooding and to extend the flood duration in the riparian zone. Indicative estimates of the low to average flow levels, flood level and initial geomorphic assessment showed, that the most appropriate section to implement restoration measures is a so called ‘hinge point section of the river’. The evidence shows that the bottom of the river section upstream of the hinge point section is declining. Downstream of the hinge point bed levels may have locally risen slightly due to deposition of bedload derived from bed erosion upstream in the degrading reaches. Slope adjustments through upstream degradation and downstream aggradation may mean that the long-profile is approaching a graded condition and that the processes in the hinge point section control the downstream sections and have the greatest impact to the flood dynamics in the riparian zone. For the estimation and prediction of the environmental effects of implementation of measures such as a) introduction of weirs, b) feeding of gravel, c) mobilisation of river banks gravel and river bank, d) revetment beyond optimal width. For that purpose river topography, hydrology and sediment transport levels on the Mura River were studied.

Technical studies for the best solutions in implementing the proposed measures were prepared on the basis of scientific evidences, field measurements and investigations of land ownership, existing water use rights and administrative procedures needed in Slovenia. In the paper the legal aspects concerning the implementation of the project will be presented.

SHOULD WE CONSIDER SMALL SCALE BEDFORM STRUCTURES ON THE RIVER BED AS PART OF WIDER SCALE RIVER ENGINEERING / RESTORATION PROJECTS?

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Bedform structures are collections of cobbles and boulders jammed or imbricated together forming distinct recognizable structures. Forms may include channel spanning (or partial spanning) steps, isolated rock clusters and a variety of linear and cellular type structures. Channel spanning steps have long been used to stabilize the river bed, and various forms are described in river restoration and habitat enhancement manuals. Such structures commonly occur naturally in steep rivers and streams. In lower gradient rivers other structural forms dominate, such as isolated clusters and cellular features. Recent work, both laboratory and field based experiments, have shown that these types of structures can increase the stability of the river bed by up to four fold. They act to decrease the bedload, reduce the mobilized grain size and reduce the total area of river bed disturbed.

Recent work has also demonstrated the importance of bedform structures for aquatic life in rivers, in particular the invertebrate community. They stabilize the streambed and hence reduce the damaging effects of floods. Bedform structures also generally support a higher density of invertebrates and greater number of species than other areas of the streambed. Indeed, some species of invertebrate appear to be only found on bedform structures. They also tend to be associated with increased coarse particulate organic matter (an important food supply) and high bryophyte biomass, and may represent important sites for invertebrate oviposition.

The value of small scale bedform features should not be lost within large scale river restoration or engineering projects. It is anticipated that maintaining existing structures or recreating structures will have a positive affect on the overall health of watercourses and will assist in restoring areas of modified river.

HYDROMORPHOLOGY AND FLOOD RISK MANAGEMENT IN IRELAND FOCUSING ON ROCK RAMPS AS A SUSTAINABLE SOLUTION

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The Office of Public Works (OPW) is the lead authority in Ireland for river drainage and flood relief functions. OPW maintains a network of 11,000km of watercourses for drainage & flood relief purposes with an ongoing programme of new urban Flood Relief Schemes.

Ireland's Article 5 Initial Characterisation Report under the WFD establishes that Hydromorphology is the 2nd largest pressure behind Diffuse Pollution. Hydromorphology accounts for 40% of the river waterbodies being designated either "At Risk" or "Probably At Risk". This comprises of pressures from Channelisation and Flood Relief structures accounting for 23% of river water bodies and Intensive Land Use pressures accounting for the remaining 17%. Present understanding is that the majority of hydromorphological pressures will not cause failure of Good Ecological Status (GES) and these water bodies are not being designated as pHMWBs (proposed Heavily Modified Water Bodies).

A method to assess Hydromorphology in Irish rivers is currently being developed to assist with the further characterisation required. For Drainage/Flood Relief pressures in Ireland, the Hydromorphology agenda will focus on enhancement of channelised rivers and sustainable flood relief practices. In addition, Ireland is incorporating River Continuity into the hydromorphological criteria which will set the future framework to manage fish passage obstructions.

Sustainability in future Flood Relief Schemes is now underpinned with a new national Flood Policy. An example of good practice is where a concrete weir which was reconstructed under a recent Flood Relief Scheme had resulted in fish passage problems. In September 2006 a Rock Ramp construction was built into this weir. This is the first Rock Ramp construction in Ireland and has proved very effective in this application. Its structure allows migration of many aquatic species, not only the stronger swimming salmonids, it is seen as a more holistic approach to river continuity obstacles and is sympathetic to a more natural morphology. Note that this type of structure requires reasonable space and involves both Engineering and Hydraulic design. It is not applicable for all river continuity scenarios but for future FRM in Ireland, it is now a prominent option in building up a suite of sustainable solutions.

Emanating from our Rock Ramp research, the most informative publication on these nature-like fish passes is DVWK, 2002. *Fish Passes – Design, dimensions and monitoring*. Food and Agriculture Organisation of the United Nations, Rome.

For enhancement of Drainage Maintenance operations, the OPW propose to commence a 5year Environmental River Enhancement Programme in 2008 as the first phase of a long-term strategy. Changes in Hydromorphology and Biodiversity are to be measured to assist in compliance with the WFD and Ireland's National Biodiversity Plan.

"AS NEAT AS A NEW PINN"

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The River Pinn runs through Hatch End in Pinner, and in the urban area has been subject to culverting, straightening and lining with concrete along parts of its length.

Culverts that were installed many years ago are now proving inadequate for the flows being experienced, and an Environment Agency/London Borough of Harrow study identified a number of areas at risk of flooding – and indeed where flooding had been experienced in recent years.

The London Borough of Harrow decided to proceed with the diversion of a 600m length of the River Pinn which ran through an old brick culvert, then in a concrete lined channel before being constrained as a straight channel within Network Rail land.

The diversion ran through land which was all in the ownership of the borough, and which comprised playing fields, an area leased to beekeepers, and an area of public open space. This ensured that land ownership issues – the bane of so many projects – were not encountered.

The project team included members of the London Borough of Harrow, the Environment Agency, Atkins, and AccordMP, the borough's framework consultant/contractor team.

Approval to proceed with the scheme was not given until April 2006, and although hydrological information and environmental surveys had been carried out in advance, no design work on the diversion had been started by then. However, the project team quickly worked up a restoration scheme for the 600m of new channel which included meanders, pools, riffles, varying side slopes, low berms and a wetland area. A workshop was held and consultations carried out, which confirmed the acceptability of the proposed scheme.

In early August 2006, immediately after the Environmental Report for the scheme had completed its period of advertisement, work commenced on site. The job was completed by early October 2006, just in time to take the heavy rain that occurred that month.

No spoil was taken off site, as it was all used to improve the playing fields, which were previously somewhat undulating. The playing field restoration was carried out by a specialist playing field contractor.

The restored River Pinn looked neat and pristine immediately after excavation, but soon began to 'naturalise' as high flows caused minor erosion and deposition in the places where this was anticipated. No planting was carried out, but the banks and wetland areas started to turn green in the mild but wet autumn of 2006, and there is every indication that the new Pinn is turning not rusty, but rustic as natural river processes and colonisation from upstream takes place.

THE DEVELOPMENT OF A CATCHMENT APPROACH TO HABITAT RESTORATION

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1. Background

The WFD requires Member States to provide an assessment of pressures and impacts on the hydromorphology of surface waters. Those water bodies identified as at risk of achieving ecological objectives (good ecological status, GES) will be required to be restored to good status by the year 2015 subject to derogation/designation criteria. Water bodies designated as Heavily Modified Water Bodies (HMWB) will have to achieve the objective of good ecological potential (GEP) which may require mitigation measures to improve existing habitat conditions. These improvements will be achieved through a programme of measures and through regulatory regimes to control all those engineering activities potentially impacting surface waters.

The concept of sustainable flood risk management recognises that we need to learn to live with flooding to a certain degree and promotes the notion of reducing flood risk. The idea of working with natural processes is now recognised as key to the delivery of successful catchment scale flood risk management.

To date restoration of habitat has generally been opportunistic and at a local scale when and where there is appropriate funding and local interest. Very little is know about the effectiveness of restoration and habitat creation in relation to reducing the risk of flooding and its applicability on a catchment basis. The same can be said regarding knowledge of the ecological benefits of restoration schemes and the degree to which previous restoration schemes are subject to pre and post project monitoring is currently limited.

2. Project Aims

To develop a catchment based decision support system for promoting habitat restoration with the aim of:

- Reducing flood/morphological (erosion/sedimentation) risk;
- Delivering ecological improvements required under the Water Framework Directive (WFD).

An overview of the project will be provided detailing:

- Potential drivers for “catchment” based restoration;
- Development of restoration strategy and decision support tool;
- Application to trial catchment “On Trent” initiative.

HYDROMORPHOLOGY AND WATER FRAMEWORK DIRECTIVE – CAN RIVER RESTORATION PROVIDE THE ANSWERS?

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The adoption of the Water Framework Directive (WFD) by the European Commission in December 2000 represented a paradigm shift in the way that Member States will manage the water environment for the future. A key element of this change is the introduction of the term "Hydromorphology", which is used to describe the overall quality of rivers, lakes, estuaries and coastal waters in terms of their physical (geomorphological) and hydrological properties. The WFD recognises the importance of these properties in supporting a healthy ecosystem by using hydromorphology as a measurable indicator for assessing the quality of the aquatic environment and also identifying external pressures.

One of the aims of the WFD is to achieve "Good Ecological Status" (GES) in all surface water bodies by 2015. It also aims to prevent deterioration in the status of these water bodies. The River Basin Characterisation Reports for England and Wales published in 2005 identified that 42% of river water bodies, 77% of coastal waters and 91% of estuary waters are at risk of failing GES as a result of 'morphological pressures'.

Whilst some of these water bodies can be designated as Heavily Modified Water Bodies or Artificial Water bodies and hence aim to obtain the alternative objective of Good Ecological Potential (GEP), the challenge still remains to determine and implement measures which will ensure the surface water bodies achieve GES or GEP by 2015.

River restoration has been identified as one possible measure that could be used to improve the ecological status of a water body. However, a number of challenges and constraints currently exist in applying river restoration techniques within a WFD context.

This presentation will explore the hydromorphological requirements of the WFD and discuss the current constraints in implementing river restoration techniques to improve ecological status. This presentation is based on a report completed for the Environment Agency that assessed the current status of hydromorphology work related to the WFD in the UK and abroad and identified major knowledge and research gaps.

THE MERSEY BASIN CAMPAIGN: LOCAL ACTION TO DELIVER THE OBJECTIVES OF THE WATER FRAMEWORK DIRECTIVE

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Introduction

The Mersey Basin Campaign was established in 1985 as part of a series of initiatives developed by then Secretary of State for the Environment, Michael Heseltine. The Mersey Basin Campaign has always worked toward three core objectives:

- Improving river basin quality
- Encouraging sustainable waterside regeneration
- Engaging all sections of the community

The key to the Mersey Basin Campaign approach is partnership working; involving representatives from the public, private and voluntary sectors. The Mersey Basin Campaign works at the local level through a network of Action Partnerships.

In relation to the delivery of the Water Framework Directive, the Mersey Basin Campaign has considerable experience in the areas of community involvement and awareness raising.

Community involvement

Working to engage the local community has been a key feature of the Mersey Basin Campaign's involvement in the European Artery programme. Artery aims to transform post-industrial urban watersides into modern day assets for the community. The Mersey Basin Campaign was involved in the delivery of two projects as part of the first phase of Artery: Speke Garston coastal reserve & Mersey Vale nature park.

The Mersey Basin Campaign, and partners, employed a range of innovative techniques at both sites to gather the views and aspirations of the local community. The Campaign believes that this type of approach is essential if the Water Framework Directive objective "to involve the public in order to secure the enforceability of objectives" is to be realised.

Awareness raising

The work of the Action Partnerships at the catchment level aims to raise awareness of local water & waterside issues. A wide range of projects are delivered each year. For example, the restoration of Eaves Brook as part of the River Ribble WFD pilot programme and tackling invasive plant species in the catchment of the rivers Douglas & Yarrow.

At the sub-regional and regional levels the Mersey Basin Campaign delivers a range of awareness-raising projects such as the annual Mersey Basin Week, a series of forums and a conference, produces a quarterly magazine, Source NW, and maintains a website. The Mersey Basin Campaign engages local authority planners in the delivery of Water Framework Directive objectives through the ENMaR programme.

RIVER RESTORATION MONITORING AND POST-PROEJCT APPRAISAL – WAYS FORWARD TO DEMONSTRATE RESTORATION POTENTIAL FOR DELIVERING GOOD ECOLOGICAL STATUS

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River restoration is increasingly seen as the way to achieve ecologically improved species richness and diversity in aquatic systems. Two main processes operate which determine the success or failure of a project in terms of ecological gain. In summary these are:

1. Deterministic processes that operate by increasing the geomorphological patchiness within a reach.
2. Stochastic processes where potential for ecological improvement are controlled by the local conditions in terms of 'supply' of species.

In many river restoration projects it has been assumed that improving hydromorphological diversity will lead to ecological improvement but there is growing concern that project success may be limited by local species supply. Evidence however, remains limited. The WFD requirement to increase river habitat quality means there is now an urgent need to increase the scientific evidence about how river restoration can help achieve this.

Monitoring and post-project appraisal of projects must become higher on the restoration agenda. Currently there is no standard integrated, scientifically sound, monitoring protocol that takes account of project scale, cost and initial objectives to define suitable levels of pre- and post-project appraisal.

In December 2006 the RRC organised a workshop specifically aimed at initiating the idea of a natural science-based, multidisciplinary monitoring protocol for river restoration projects. The workshop was very successful and highlighted key ways forwards to achieving an industry standard manual.

This presentation will outline the outcomes from that workshop and provide an opportunity for others to register an interest in being involved in future developments.

APPRAISING URBAN RIVER RESTORATION PROJECTS: THE QUAGGY RIVER AT SUTCLIFFE PARK, SOUTHEAST LONDON.

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The River Quaggy is part of the Ravensbourne Catchment in Southeast London, one of the most densely urbanised catchments in the UK with a long history of channel management. In 1992 a survey of the Ravensbourne catchment by the National Rivers Authority revealed that nearly 90% of its river reaches had been highly modified through the construction of culverts or channels with artificial linings (Copas, 1997). Against this background, a number of multifunctional river restoration schemes have been completed in recent years.

The aim of the River Quaggy restoration scheme at Sutcliffe Park, undertaken as part of a catchment-wide flood alleviation plan, is to provide flow attenuation and flood storage as well as deliver a range of environmental and social benefits. This paper presents the findings of a post project appraisal conducted in 2006 focusing on the geomorphology, ecology, and water and sediment quality of the river two years after the completion of the restoration works.

Comparison of the river channel geometry with the "as built" surveys showed that the river channel had not undergone any significant post-restoration adjustments at the reach scale and retained a diverse form. The presence of instream macrophytes had a major impact on river flow velocities and the deposition of fine sediments. Appraisal of the sediment and water quality revealed concentrations of trace heavy metals within the channel and floodplain sediments and in the river water that exceeded a number of sediment quality guidelines. The instream and marginal plant species were those characteristic of: (1) lowland rivers with minimal gradient in England (Type I, Group A1 rivers); and (2) rivers with impoverished ditch floras in lowland England (Type IV, Group A4) (after the classification of Holmes et al., 1998). Not surprisingly, the macroinvertebrate composition was dominated by pollution-tolerant taxa.

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ECOHYDROLOGY AND THE FLOOD RISK MANAGEMENT IMPLICATIONS OF WET WOODLAND RESTORATION.

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Restoration of floodplain woodlands represents a complex challenge for ecosystem managers and scientists. This arises from the complexity and dynamics of these systems (Hughes *et al*., 2003), the paucity of knowledge about their process and functioning (Jeffries *et al*., 2003), and the implicit assumption that they represent a flood risk (Kerr & Nisbet, 1996). Paradoxically, floodplain woodlands are among the rarest of riverine ecosystems, and enjoy protection under a number of conservation designations. This paper reports the initial results from a 3 year monitoring study of a floodplain wet woodland restoration in the SAC/SSSI designated New Forest streams. At the start of the project concerns were raised about the impact of the restoration works on downstream flood risk. This can be summarized as 1) the restoration would create more over-bank flooding downstream, and 2) the restoration would result in more wood transport into downstream reaches (and hence higher flood risk). Conversely, habitat requirements of the restoration required increased floodplain connectivity and the creation of appropriate patterns and dynamics of over-bank flow. An intensive monitoring programme was undertaken before, during and after the restoration. The results of this demonstrated that the processes of floodplain inundation were strongly controlled by channel capacity, meander geometry and the presence of large wood structures (dams, jams etc.). The specific patterns of over-bank flow were controlled by the topography of the floodplain, itself influenced by the presence of trees and wood. Inundation frequency and duration post-restoration matched those observed in reference reaches. Significantly, the result of the restoration has been to increase the retention of wood within the catchment, and to increase the flood travel time, through increased storage and enhanced channel and floodplain roughness.

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http://www.forestry.gov.uk/forestry/infd-6argj3

ASSESSING MONITORING TOOLS FOR EVALUATING BIODIVERSITY OUTCOMES OF RIPARIAN REHABILITATION: APPROACHES AND ALTERNATIVES FROM A RIVER DOWN-UNDER

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Rivers and their floodplains in the Hunter Catchment, New South Wales (NSW), Australia, are degraded as a consequence of clearing native vegetation and infestation by exotic plants. A nationwide audit on catchment condition concluded that the Hunter's river systems were generally worse than that of other coastal rivers in NSW and the report made specific note that the Hunter Catchment was in need of remedial work. Local community groups using public funds have been actively replanting riparian corridors and floodplains with native vegetation for some years now with multiple goals including: (i) creating ecosystems that provide improved habitats for native species; (ii) improving biodiversity values; and (iii) improving ecosystem functioning. To evaluate progress towards such goals, effective monitoring tools are required so that time and funds are spent wisely. Indeed, government-funding bodies now require the objectives of rehabilitation projects to be measured in terms of outcomes and reported as such. However, very little is known about the ecology of riparian systems in Australia, nothing is known about the effectiveness of native revegetation as a management intervention and there are no predetermined standards or expected norms that monitoring, by definition, requires. Terrestrial invertebrates have been recommended as bioindicators for evaluation programmes because of their abundance, importance in ecosystem function and their relative sensitivity to environmental change. However, monitoring invertebrates is often not feasible by community groups because of the high costs of both laboratory sorting and storage of specimens. Monitoring invertebrates also requires access to both specialist equipment and taxonomic expertise. Moreover, there is a perception by some of the scientific community that data collected by 'citizen scientists' are unreliable. Here we present the results of research to develop and test monitoring tools that comply to the following criteria: (i) cost-effective; (ii) limit or eliminate laboratory processing and expertise; (iii) easily collected by community groups; (iv) based on processes that invertebrates are responsible for; and (v) indicative of, and related to, successive stages of riparian revegetation. Several monitoring tools that complied with some of the above criteria such as scoring insect leaf damage, measuring rates of seed removal by ants and assessing the diversity of web-building spiders (using features of their webs) were developed and tested. These alternative monitoring tools were then compared, at the same sites, with 'traditional' invertebrate tools such as species richness and abundance estimated using conventional invertebrate sampling techniques such as pitfall traps. Alternative monitoring tools were further trailled at community-attended workshops where we examined observer accuracy, precision and method useability. Quantitative and qualitative data from these workshops were used to further refine methods and a number of important outcomes were gained through post-workshop evaluations. As will be discussed, a number of recommendations regarding the use of these monitoring tools for evaluating biodiversity outcomes of riparian rehabilitation are made.

"PLANNING A PHYSICAL SETTING ABLE TO REDUCE HYDRO-MORPHOLOGICAL RISK IN THE AGGRESSIVE GESSO STREAM (PIEMONTE, I) THROUGH RIVER RESTORATION LOOKS ECONOMICALLY REWARDING" ([1])

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Gesso is a an aggressive river that since long time has been managed by building more and more defence works in order to "reclaim" and occupy land that originally belonged to the river. However, repeatedly the river came back to its territory vanishing human efforts and producing damages. Comune di Cuneo, the local Municipality, in coordination with other three municipalities along the same river stretch, decided to explore alternative ways of managing the river corridor.

With our "Gesso project" we tried then to evaluate through a simplified cost-benefit analysis whether a more natural "physical setting" of the river (i.e. more space to the river), together with a suitable land use management mechanism, would be economically more rewarding than the classic approach (subtracting land to the river, remove sediments from the river bed and build defence works). "Physical setting" means: space allocated to the river -that is land use (change of) destination- plus (or minus) defence works. Costs include building and periodically re-building the planned defence works plus the land use value-change implied by giving more or less space to the river, plus any re-settlement of current activities. Benefits are assumed to coincide with the reduction of risk. Risk here is mainly associated with land loss due to bank erosion. To assess such a risk we estimated, on the one side, land loss probability according to a geomorphological analysis, integrated by expert judgment, and, on the other side, the land value, according to a market-value approach or a productivity approach, depending on the type of land. The methodology adopted included:

- pointing out some key questions related to hydrology and geomorphology (e.g. "is the river over loaded with sediments?", "what is the proper space of the river?") and trying to find answers by analyzing the empirical evidence (aerial photographs, field surveys, hydrological records,…) through a conceptual model;
- defining some solution alternatives (at a preliminary level), including physical setting and land management mechanisms;
- estimating consequent effects (basically through qualitative modelling and expert judgement);
- carrying out at a preliminary level an economic evaluation of the alternatives.

The results obtained lead to two conclusions: on the one hand, if an effective compensation mechanism for land use change is adopted ([2]), then restoring the river is the most rewarding alternative as it costs nothing in terms of works, implies no land value losses and reduces risk (because of the modified allowed land use). On the other hand, the "classical" approach is not rewarding because, basically, the cost of works is not compensated by the reduction of risk. The first conclusion is affected by the assumption of disregarding re-settlement costs ([3]), the second is not. Finally, the removal of sediments is not advisable because it would feed the same perverse cycle: narrowing→ new land uses (values at stake) in the corridor→ future flood events→ sudden widening (bank erosion)→ damages and costs.

[1] From a study carried out by: Andrea Nardini, Daniele Sogni, Jacopo Crimi, Fulvio Anselmo and Paolo Cotignoli for Comune di Cuneo (I), funded by Cassa di Risparmio Provincia di Torino (CRT, Torino, I), 2004.

[2] An owner of a plot nearby the river can give it to the municipality in exchange of a permit for increasing the constructed volume that can be realized in another land destined, in the urban regulatory plan, to urban expansion; a market of exchange of land-use destiny can be thus set up. A land use-change inserted in such a mechanism would thus induce substantially no change in the assets value of the community.

[3] Few situations might have required such a measure, in any case we are talking of a semi-rural context with low anthropic pressure.

CATCHMENT RESTORATION FOR FLOOD RISK AND SEDIMENT MANAGEMENT: PONTBREN, MID-WALES

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There is a growing perception that intensive farming practices in upland areas of the UK have increased soil erosion rates and downstream flood risk. Higher stocking densities have reduced soil permeability through top-soil compaction and natural vegetation has been removed through grazing pressure and conversion to grassland. These factors have resulted in greater levels of surface runoff following rainfall, causing widespread soil erosion and increasing the potential for diffuse sediment transfer to watercourses. Elevated sediment yields and bank erosion rates in rivers and streams are also likely as a consequence of more frequent, higher magnitude floods. Such effects can have serious implications for aquatic habitats and the ecosystems they support.

A pioneering catchment restoration scheme in mid-Wales may help to alleviate these problems. A farming collective in the Pontbren catchment, near Llanfair Caereinion in the headwaters of the River Severn, are adopting a more sustainable approach to upland land management to address mutual problems of uncertain markets, loss of farm support, low prices, falling income and a decline in the natural environment. Restoration work has focussed on the regeneration of broad-leafed woodland and hedgerows throughout the catchment. Fencing off streamside and marginal areas of land for tree planting has cut expenditure on maintenance and provides benefits such as shelter for livestock, woodchip through coppicing and wildlife habitat. However, the most significant effect of the tree planting may be its influence on soil structure and function. Infiltration rates were found to be up to 60 times greater in planted woodland areas compared to adjacent grazed pastures, suggesting the restoration programme could reduce surface runoff, erosion and sediment transfer throughout the catchment.

An extensive multi-disciplinary experimental programme has been established in the Pontbren catchment by members of the Flood Risk Management Research Consortium (www.floodrisk.org.uk). The work aims to quantify the impact of changes in upland land management on flood runoff generation and sediment transfer, and determine how effective the restoration measures are at reducing these problems. This will be supported by a socio-economic analysis of the project and relevant stakeholders. Results from the monitoring programme will be presented and used to predict the effect of future land use scenarios on sediment yields and morphological change. The Pontbren scheme provides an excellent example of the many benefits of catchment-scale restoration and, by delivering sustainable environmental and economic results, holds important implications for river restoration and flood risk management in the UK.

POST KATRINA: THE IMPORTANCE OF SEDIMENT TO MANAGING RESTORATION OF THE LOWER MISSISSIPPI RIVER DELTA

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During 2005, Hurricane Katrina caused severe coastal flooding to the city of New Orleans and throughout the Mississippi Delta, killing hundreds of residents, displacing many more thousands, and causing an estimated $200 billion in economic damage. Katrina also caused dramatic loss of land to a delta that had already suffered high rates of land loss over the last 50 years. Land loss amplifies the future flood risk to lives, people and property throughout the Delta region.

One of the most important factors explaining high rates of historic land loss in the Mississippi Delta is the reduction of sediment supplied from the Lower Mississippi River onto the delta. Historically, sediment was delivered from the main river onto the delta by distributary channels and overbank flooding. However, during the twentieth century, channel management activities along the upstream river and throughout the wider basin have reduced sediment supply to the delta. This reduction in supply has been exacerbated by recent increases in the height of flood protection levees along both banks of the main river, effectively disconnecting the main river from its deltaic plain. The result of these changes is that the majority of sediment delivered to the delta is now transported downstream into the Gulf of Mexico and does not contribute to deltaic growth.

In response to long-term land loss and dramatic recent flooding, the U.S Army Corps of Engineers is currently undertaking an ambitious appraisal of management options to promote river delta restoration and improve the level of flood risk protection to vulnerable communities. This paper presents an overview of this process, and demonstrates the importance of improving our underlying knowledge of sediment dynamics in meeting this long-term objective.

PRINCIPLES AND TECHNIQUES FOR THE ECONOMIC VALUATION OF RIVER RESTORATION PROJECTS

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It is increasingly recognised that human welfare depends on the world's stock of natural capital and the flows of eco-system services that this provides including: food and fibre, regulation of hydrological and atmospheric processes, and habitats for a variety of species including humans. Riverine systems can be thought of as natural capital which provides a range of eco-system services to society. For example, healthy river systems decompose wastes, redistribute sediments, provide fresh water, replenish habitats during flooding, and provide important landscape features (Postel and Richeter, 2003). While natural river flows are essential to sustaining riverine systems and ensuring that these continue to provide a range ecosystem services, few of Europe's rivers can be defined as natural. Many rivers and floodplains across Europe have been degraded as a result of human activity, especially where rivers have been 'engineered' and disconnected from their immediate floodplain

River restoration aims to address these problems by re-establishing self sustaining riverine systems that can allow the form and function of a river to develop as naturally as possible under present and future climatic regimes (Mant & Janes, 2006). River restoration in urban areas focuses on improving the quality and function of river environments and thus entails the removal of engineered structures to restore natural channel form. While river restoration in urban areas often focuses on the river channel, more ambitious schemes aim to reconnect rivers to their floodplain.

This paper considers the economic valuation of river restoration by focusing on the enhancements in riverine natural capital and thus the eco-system functions and services that this provides. A variety of methods to undertake this task are reviewed. Emphasis is given to the 'functions, uses and values' framework put forward by Costanza *et al*, (1997) de Groot *et al* (2002) and Turner *et al* (2003) as well as a similar conceptual framework used in the Millennium Eco-system Service Assessment (2005) which defines eco-system services as supporting, provisioning, regulating and cultural. Such an approach can help to identify and potentially value the diverse benefits of river restoration. It can, by developing an understanding of the trade-offs and synergies amongst different types of ecosystem services, help to design restoration projects that maximise overall welfare, engaging stakeholders in the process.

THE QUERCUS PROJECT

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Chester City Council is working in partnership with the London Borough of Lewisham and Hertogenbosch in the Netherlands to deliver the QUERCUS project. QUERCUS aims to maintain Quality Urban Environments for River Corridor Users and Stakeholders - or, put another way, to create Rivers for People. Partners are focusing on a specific area of river corridor in each location:

In Chester the River Dee SSSI and SAC flows through the heart of the city. A riverside visitor centre and café, cycle route and footpaths have been built to improve access to the river corridor, create links between greenspaces and promote the importance of urban biodiversity.

In Lewisham, this is the River Ravensbourne as it flows through two urban parks, the 150 year old Ladywell Fields and the newly created Cornmill Gardens; a modern town centre park at the heart of a major regeneration initiative.

In 's-Hertogenbosch it involves the stretch of the River Dommel alongside the restoration of the historic city walls and the Bastion Maria. The plans also include a major flood storage overspill project integrated into the works.

In all three locations the objectives of QUERCUS remain the same:

- To increase use and enjoyment of the urban river corridor
- To see a decrease in crime and fear of crime
- To improve habitats for wildlife

Flood prevention schemes and urban development have, in the past, often led to urban rivers being enclosed in concrete, hidden or ignored. Local Authorities have been reluctant to invest in rivers perceiving that any improvements made would soon be spoiled by dumped rubbish, vandalism and crime. The QUERCUS project aims to enhance each river corridor to be an attractive feature of an urban environment by transferring the approach of Designing Out Crime from housing developments and testing it in an environmental setting. Through increased visibility, encouraging greater usage and ownership and clarifying the function of every part of the open space, opportunities for anti-social behaviour and criminal activity will be significantly reduced, residents and users will feel safer and the environmental quality of the area will be consistently higher. The re-naturalised or newly accessible river corridor will then form a central part of the Local Authority's environmental commitment linking Green Networks, cycle routes, areas of biodiversity and recreational facilities.

For further information please visit: www.quercus-project.eu

RIVER RESTORATION ON THE RIVER WITHAM – SEEING THE BIGGER PICTURE

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Initially the River Witham five year package of bank raising and toe protection measures seemed to offer little in the way of river restoration opportunities. The river is heavily modified, being straightened and embanked throughout its length, with a significant amount of stone toe protection. The water is maintained as a lower level in the winter than in summer. This has led to drying out and slumping of the bank toe which remains devoid of vegetation and would not allow for soft toe protection to be used. On the plus side the river is within the Lincolnshire fens, with excellent opportunities for wetland restoration and the area is rich in archaeology. The relevance of the archaeology was reinforced by the excavation of an Iron Age causeway and two dug out boats, amongst other finds, as part of the first phase of the works. The river is also used extensively for leisure boating.

The presence of extensive drains, sluices and embankments would not allow for setting back of banks, recreation of meanders or creation of a two stage channel. However an opportunity arose when a potential source of clay for embankment creation was identified. Talks were held with the local wildlife trust with a view to securing their agreement to take over the management of the 5.5 ha site in the long term if the Environment Agency could purchase the site, remove the clay and restore the area to wetland. At this stage we started to think about ways in which we could link the site with the river, and the other key factor – the rich Bronze and Iron Age archaeology in the area. The additional funding required was provided by Lincolnshire Waterways. A bird hide was therefore designed in the form of an Iron Age round house. Replica round barrows were also created opposite the roundhouse. A mooring was provided on the Witham to allow visitors to moor up and visit the site. Most importantly the team involved the parents and children at the local rural primary school. Presentations were given to the parents and the children were taken to visit the site and another nearby site, and took part in a clay tile decorating workshop, the tiles being used to decorate the inside of the roundhouse.

The resulting site provides biodiversity value (open water, reedbed, alder coppice and wet grassland) as well as an insight into the Iron Age landscape and habitats that were present on the site over 2000 years ago. This provides a broad experience for visitors, adding a new dimension to the habitats and species they can see at the site and perhaps a better appreciation. The site also links into other wildlife sites and a new museum in Lincoln.

On the river itself we were stuck with stone toe protection, but wanted to make it as biodiversity friendly as possible. A design was developed which created a rock reef out in the river, which had the same benefit in reducing toe erosion, but allowed marginal habitat to form behind the reef. Gaps were left at intervals to allow a flow of water through the reef area. This area soon filled with marginal vegetation, providing valuable habitat where there had been none for many years. The Environment Agency is now considering undertaking a study on the River Witham to assess the feasibility of maintaining a year round river level which would allow for softer bank protection techniques to be adopted in the future.

REHABILITATION OF THE MORAVA RIVER TO ENHANCE NATURAL RIVER FUNCTIONS AND FLOOD DEFENCE

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The lower part of the Morava river basin creates a natural wetland ecosystem with valuable floodplain landscapes, which is unique in Central Europe. This area extends from the Dyje River to the Danube confluence, creating the international border between Slovakia and Austria. River regulation and other human interventions have significantly influenced their natural river and floodplain processes. This has adversely affected its wetland ecosystem, which, if not rectified, could permanently impair the original character of this lowland meandering river.

In order to protect the ecological value of this unique area against progressive degradation and to improve its restricted lateral connectivity, selected cut-off meanders were reconnected to the main river channel on the Slovak side of the river. Lack of knowledge of the key river/floodplain processes (hydrological regime, flow dynamics, sediment transport) prior to its implementation resulted in a progressive reduction in the success of these restoration measures.

Further restoration measures were subsequently independently undertaken on both sides of the river. Monitoring results, which indicated a failure to achieve the desired objectives, identified the urgent need for closer international cooperation and for the elaboration of a common Slovak-Austrian restoration and management strategy. Multidisciplinary teams from both countries have been working together on these problems in recent months as part of an EU-INTERREG project: Bilateral Project Morava- Common Management of Hydroecological and Water Management Measures. Various restoration scenarios have been proposed and appraised against data that has been collected on key river processes and the results of abiotic/biotic monitoring. Optimal procedures for the sustainable integration of several cut-off meanders into the river system have now been proposed. Further restoration measures are being considered for the river channel and its flood plain in order to facilitate achievement of good ecological status (linked with Water Framework Directive).

Significant parts of this project are focused on flood control. The principle aim is to restore some parts of the original flood plain (behind constructed flood dykes) in order to increase their retention capacity, reduce flood risk and improve moisture conditions in the protected landscape area. In addition, there are plans to create a number of polders, improve the storage capacity of some relict water bodies and to restore flow in a small tributary stream. Collectively, they would improve flood management and further reduce flood risk on the Morava River. Temporary flooding of the area behind the dykes, as well as restoration of the small relict rivers and water bodies, will significantly improve ecological conditions in selected parts of the original river flood plain within the Protected Landscape Area - Záhorie.

Project results significantly contribute to the active protection of the unique ecosystem of lower Morava wetlands and will help to the better implementation of Water Framework Directives–EU.

BILATERAL GENERAL PROJECT MORAVA II (BGM II)

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The EU Water Framework Directive came into effect in December 2000 and demands a comprehensive review regarding water protection, which also incorporates nature protection and land use. The Directive requires an assessment of the ecological and chemical status of water bodies and furthermore the elaboration of a plan of measures with the aim of reaching "good ecological status". Furthermore the guidelines of the European Union shall be combined with the requirements of local citizens.

Essential preliminary work has been undertaken on the Austrian and Slovakian sides of the Morava River. Nevertheless the necessity of a bilateral collaboration is essential for further success. These considerations lead to the "Bilateral General Project Morava", an INTERREG IIIA project between Austria and Slovakia, part-financed by the EU Community. The overall objective is to design a strategy for the revitalisation of the river system. Flood protection has been the most important security factor for settlement areas and land use in both of the boarding countries. In addition to the requirements of the Water Framework Directive, the requirements of the Fauna – Flora – Habitat – Directive and the Conservation of Wild Birds Directive (Natura 2000) have to be met by this project.

In the first phase of the project (bgm I) preparatory work and surveys of the present situation were undertaken. The main focus of the second phase of the project (bgm II) lies on the assessment of the river system and the development of a plan of measures. It is divided into 6 different modules.

The focus of module 1 is the assessment of the lower Morava River from Hohenau to Devin (km 0–69) according to the Water Framework Directive and the corresponding elaboration of a deficit analysis. As this is carried out before the respites of the European Union it can be seen as a pilot project. Module 2 deals with the scenario analysis, where different scenarios are developed according to the standards of flood protection and the EU Directives as well as objectives of the public participation. In Module 3 the river engineering and ecological model is discussed and established out of the favored scenario. Module 4 contains the compilation of the catalog of measures, which contains the listing and the description of potential measures at the Morava River. In Module 5 the established model is transformed into a plan of measures, including a description of the measure proposals. Module 6 deals with the public participation, in which the public is integrated in the discussions, and measure proposals are considered in the development of the scenarios and the module.

According to the assessment of the biota, the Morava River is at present in a "moderate status" and therefore the need for action is identified. The developed plan of measures is based on all previous investigations and analysis and shall show all possibilities of measure proposals in consideration of the provided framework requirement. The focus of the flood protection within this project lies on non-structural protection measures and floodplain management. Aside from that, measures to improve lateral connectivity are also included, for example the reconnection of cut-off meanders. In addition measures to improve the groundwater situation, the water quality and the sediment situation were also developed. A focus also lies on the condition of the tributaries and side channels.

Concluding the importance of pursuing the collective river body approach and following the bilateral perception has to be pointed out.

LIVING RIVER LIESING – IS REHABILITATION OF A HEAVILY MODIFIED WATER BODY IN AN URBAN ENVIRONMENT POSSIBLE? RESULTS OF A LIFE - PROJECT

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The LIFE- ENV pilot project is to achieve "maximum ecological potential" for the Liesing River, as demanded by the Water Framework Directive with regard to "heavily modified water bodies". For a length of 5.5 km, a concrete channel located in an urban area is actually re-designed into a semi-natural type-specific river which also meets the relevant flood protection requirements.

The Liesing is famous for its fast rising, heavy floods, according to its origin in the geological Flysch area, where heavy showers cannot be absorbed. Disastrous flood events in the past have led to a regulation system such as lowering and straightening of the riverbed, meanders have been cut off and refilled, bed drops of up to 75 cm and a more interrupted flow in a u-shaped concrete riverbed.

The revitalisation project was planned by an interdisciplinary team of hydraulic engineers, biologists and landscapers. The reconstruction works started in autumn 2002 and were finished in December 2005.

The activities included construction measures to restore the river continuity by re-building bed drops, the restoration of semi-natural morphological conditions by integrating bays and shallow water zones, the restoration of former meanders, the construction of a semi-natural river bed with a gravel substrate, and the restoration of the river's natural transport capacity. The steep banks were flattened and partly enlarged and are locally protected by bioengineering measures (willow fascines, wattle fence). Existing valuable mesoxerophytic grassland was preserved by storing it during the construction works and re-planting it afterwards. Trees and bushes which are not native or suitable for this location were replaced by species which are typical of floodplains. An accompanying pathway and a riverside playground for children were constructed and opened to the public for recreational purposes. The project was accompanied by intensive PR activities. Three main aims of the projects were:

- Restoration of flow continuity and diversification of current velocity to enable migration of fish and macrozoobenthos
- The reconstruction of a seminatural riverbed out of a gravel layer consisting of grain sizes typical for this type of river in order to provide sufficient gaps in the sand to be populated by macrozoobenthos. These measures are changing the roughness and result in different flow velocities. In a certain amplitude the river will be able to create different depths and gravel transport, erosion and deposition can start again.
- Bank erosion-protection structures made of willows, such as fascines, wattle fences, brush mattresses and willow cuttings. These are also essential for shading the river

The most important result is an aquatic ecological corridor through the urban area with new habitats for priority species also matching recreation requirements for the urban population. A new waste water channel is accompanying the reconstruction project to improve the water quality to class II of the saprobic system.

The ecological evaluation of the project involves the monitoring of ciliats, macrozoobenthos, fish-species and vegetation, as well as hydromorphological and chemical parameters.

BLUE AND GREEN, ADDING QUALITY TO URBAN LIFE. BLUE-GREEN ALGAE FRUSTRATING URBAN AMBITIONS.

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The delta works were built after the flood disaster of 1953. In order to prevent new flooding the national government started a program to isolate the 13 estuaries from the North Sea. The project started by building dams, but it was decided that the connection to the sea of the harbours of Rotterdam and Antwerp (Belgium) should remain without serious obstacles. Towards Antwerp the Western Scheldt was surrounded by dikes (Dutch: dijk) to prevent flooding. The Rotterdam region is protected by the Maeslantkering (1997), a storm surge barrier near the port. Other estuaries were closed by dams.

During the process the government decided not to close the Eastern Scheldt by a dam. The Eastern Scheldt storm surge barrier (1986) is 9 kilometres long, 4 kilometres of it are constructed with huge sluice-gate doors to preserve marine life and fishing industry. Nevertheless, compartments developed within the Eastern Scheldt. Inland lies the town of Bergen op Zoom and in front of it a canal, connecting Rotterdam and Antwerp. Oysterdam (a dam) is located in front of this important infrastructure to protect it against tidal movements. The remaining part of the Eastern Scheldt, close to Bergen op Zoom, is isolated. The main part of the Eastern Scheldt contains sea water, and is ecologically stable. The canal and the other isolated parts contain fresh water which is flushed with water from the Rhine, Meuse and smaller rivers. However, this water is polluted with large quantities of nutrients, which cause algal blooms of Cyanobacteria. In front of the town of Bergen op Zoom lies a compartment of the Eastern Scheldt called the Binnenschelde. This isolated water is not flushed by a river – it is a freshwater lake on an estuarine substrate. Estuarine soils contain large amounts of phosphate and as a result this system is affected by large blooms of blue-green algae.

The community of Bergen op Zoom has a development plan to build a town quarter in the direct vicinity of the Binnenschelde, creating opportunities to live in this waterfront environment. This plan, ‘Bergse Haven’, involves redeveloping a neglected industrial area and building 2700 residential houses and apartments. A great ambition, however its success depends on good and safe water quality in Binnenschelde.

The city board of Bergen op Zoom announced its ambition to promote tourism. It is the most Burgundian town of the Netherlands, with a rich tradition and history. Bergen op Zoom was historically one of the most important harbours for the Netherlands.

The title of this abstract is `Blue and green, adding quality to urban life'. Increasingly urban populations are in need of adequate recreation facilities. Although Bergen op Zoom has a lot of woodlands in its neighbourhood, it is also important to be able to enjoy the surrounding water.

The city board of Bergen op Zoom would like to find a way to restore the estuarine conditions. This desire is partially based on terms of the Water Framework Directive, e.g. referring to ecological goals, and a desire for the national government to be responsible for the current situation which is a result of historical management. Other stakeholders would like to see a freshwater system - among them are agricultural organisations and drinking water companies.

The case of Bergen op Zoom is complex and we are looking for partners with bright ideas!

LOWER RIVER RODING REGENERATION

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The Lower River Roding Regeneration project was part funded by Environment Agency Flood Defence, its aims being flood defence improvements, and part by the Office of Deputy Prime Minister's Sustainable Communities fund its aims being to make environmental and access improvements along the Lower River Roding corridor for the benefit of the local people. The project budget was limited to £1m and the works had to be completed from design to construction within 2 years.

Initially we had over 40 potential schemes along the River Roding. Of these 4 have been constructed, the most relevant to river restoration being the works undertaken at the Barking Barrier Parkland and Frogmore Frontage. Here we are able to combine the Sustainable Communities funded improvements with flood defence works.

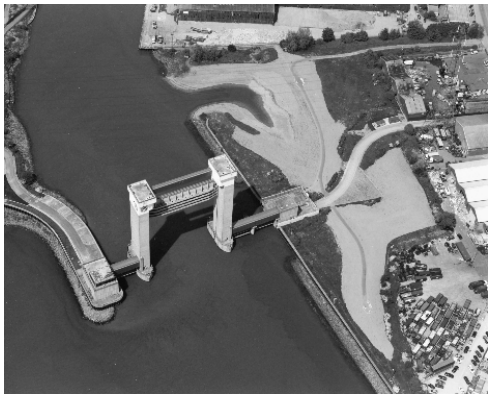
The Barking Barrier Parkland is located at the confluence of the River Roding with the River Thames. The site was a large expanse of green open space with poor pedestrian access, a hard foreshore down to the river and limited views of the River Thames.

At this site we were able to set back the flood defence and remove part of the hard foreshore to enable a tidal backwater to be created. The earth excavated to create the backwater was used on site to create a viewing point over the remaining hard defences and along the Thames.

Special care was taken in the selection of materials. Gravel used on the new foreshore at the Barking Barrier Parkland was won locally and existing plants were gathered before construction commenced, grown on off site and then replanted in the backwater. Soft engineering in the form of brushwood revetment was used as the erosion protection at the mouth of the backwater. 1Ha of saltmarsh has been created helping towards meeting Environment Agency biodiversity targets.

Halcrow's landscape architect and engineer, worked closely with the London Borough of Barking & Dagenham's Regeneration team and Environment Agency specialists to ensure that the design of the scheme was consistent with the redevelopment of the surrounding area, that environmental enhancement opportunities were maximised and that the flood defence integrity was maintained. The success of the scheme is largely due to the aspirations of these specialists being captured onto working drawings and then being delivered as intended.

The Environment Agency Project manager is Charlie Thompson (Hatfield) and the Consultants are Halcrow (Waltham Cross). J Breheny Contractors (Needham Market) were the Contractor and EC Harris (Marlow) acted as Cost Consultants as well as providing the ECC Project manager.



BOSTON COMBINED STRATEGY: MAXIMISING OPPORTUNITIES AND MEASURING SUCCESS.

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This presentation highlights the importance of setting objectives and having measurable targets so that successes can be monitored.

The Boston Combined Strategy offers exciting opportunities to deliver wide ranging objectives from sustainable flood risk management and navigation improvements through to providing environmental benefits and ultimately, supporting regeneration of the town. The Strategy is being promoted by the Environment Agency with support from Lincolnshire County Council and Boston Borough Council and represents a major investment in the area (whole life costs of £213 million).

Boston is an historic market town with an important maritime history. It is set in the low-lying and flat landscape of the Lincolnshire fens, much of which is below the level of the mean high water spring tides of The Haven (the tidal reach of the River Witham that runs through the town). The tidal river not only presents a potential flood risk but it also restricts the type and volume of waterway navigation through the town. Despite its prosperous history, Boston now faces the challenges of high unemployment and social deprivation and subsequently the focus of local development planning is aimed at regeneration and improving the quality of life within the town.

Specific objectives for the Strategy were established at the start of the appraisal process through a workshop with the project team and other key business users. A period of internal and external consultation refined the objectives to the following agreed list:

Strategic Objective:	To reduce the risk of flooding while enabling opportunities for regeneration in Boston.
Flood Risk Management:	To reduce the risk to people and the developed and natural environment from flooding.
Navigation:	To provide a safe and attractive navigation link between the River Witham and the South Forty Drain.
Economics:	To maximise amenity, social and economic opportunities.
Environment:	To minimise adverse impacts on the natural and built environment of the area and to maximise opportunities for environmental enhancement.

The strategic environmental assessment developed this list of core objectives and provided a monitoring plan with defined indicators and targets. The monitoring plan will provide the means by which the Agency and its partners can determine whether objectives have been met and consequently measure the performance of the strategy.

The Great Ouse Vision

Ian Hirst[1] (ian.hirst@environment-agency.gov.uk), Paul Jose[1], Chantal Hagen[2], and Ian Cowx[3].

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An Environment Agency and Natural England vision for river and floodplain rehabilitation in the River Great Ouse and the Fens is presented in three parts:

- The first highlights the historic pressures and impacts on biodiversity, in particular fish, an essential element of biodiversity often marginalised by the conservation community;

- The second briefly outlines the current focus on designated sites and the piecemeal approach to rehabilitation in localised areas;

- The third and main focus is on the wider countryside. An integrated set of projects at a range of scales, designed to enhance, rehabilitate and create habitat for fish and biodiversity across the catchment are presented. These include projects on floodplain backwater rehabilitation and the potential to link gravel pits to the river in the Great Ouse catchment (a collaborative project with Hull International Fisheries Institute and the Centre for Environment, Fisheries and Aquaculture Science). Several landscape-scale wetland restoration projects are also illustrated to show the benefit of large scale actions such as the The Great Fen Project and the Wicken Fen Vision. Bedford River Valley Park, a pioneering 870ha green space project in the urban fringe further illustrates the values of rivers and floodplain for people as well as biodiversity.

The approach to rehabilitation is indicative of the desire to break out of the traditional delivery of limited and piecemeal fish and biodiversity benefits and highlights the benefit of working in partnership at a range of scales. This approach should enable appropriate projects to be developed in the right locations with key stakeholders in a timely and cost effective manner to benefit the catchment rather than just localised areas.

WORKSHOP 1

USING THE RBMPs AND CFMPs TO COORDINATE RIVER RESTORATION

David Corbelli (*david.corbelli@environment-agency.gov.uk)*
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1. Background

The WFD requires Member States to provide an assessment of pressures and impacts on the hydromorphology of surface waters. Those water bodies identified as at risk of achieving ecological objectives (good ecological status, GES) will be required to be restored to good status by the year 2015 subject to derogation/designation criteria. Water bodies designated as Heavily Modified Water Bodies (HMWB) will have to achieve the objective of good ecological potential (GEP) which may require mitigation measures to improve existing habitat conditions.

2. River Restoration as an improvement measure for Hydromorphology

- To date restoration of habitat has generally been opportunistic and at a local scale when and where there is appropriate funding and local interest. Very little is known about the effectiveness of restoration and habitat creation in relation to reducing the risk of flooding and its applicability on a catchment basis. The same can be said regarding knowledge of the ecological benefits of restoration schemes and the degree to which previous restoration schemes are subject to pre and post project monitoring is currently limited.
- To determine and resource restoration priorities at the River Basin or catchment scale will require better co-ordination of exiting delivery and funding mechanisms and closer working between a wide range of stakeholders and interested parties.
- Where there are significant "gaps" to address the above (science, delivery mechanisms or funding) there remains the opportunity to address these in the time leading up to and over the duration of the first River Basin Management Plans.

3. Workshop Objectives

To review opportunities & mechanisms for development of a coordinated approach to river restoration as a measure to deliver River Basin Management Plans.

The workshop will focus on 3 key areas:

- What restoration measures could be used deliver hydromorphological (ecological) improvement targets?
- What current planning mechanisms are available to deliver river restoration?
- What are the funding opportunities for delivering river restoration?

WORKSHOP 2

RIVER RESTORATION PROJECT MONITORING

Judy England, (judy.england@environment-agency.gov.uk), Environment Agency, Thames Region

This workshop builds on a seminar that took place in December 2006. Some of the results from will be highlighted in a presentation at this conference. There is a growing recognition that there needs to be an agreed framework in which to work if we are going to learn from river restoration projects so as to increase our confidence that restoration projects are successfully delivering their main objectives. As a starting point a matrix has been suggested. This is based on applying appropriate level of monitoring techniques for a given risk and scale of project. This workshop will continue to explore the validity of the framework as an idea and firm up on what is meant by scale and risk in the context of river restoration monitoring. It will also provide an opportunity for participants to discuss how the idea of a monitoring protocol will fit with other research and development work and establish if a handbook of techniques (and how and when to apply them for river restoration gain) would be of value and whom might be the end users.

The results of the monitoring workshop held in December 2006 are currently just out to consultation with those who attended that seminar and will soon be available on the RRC website. The outputs of this workshop will also be publicly available on the website and comments will be taken into account in determining the focus of any future developments.

WORKSHOP 3

ADVANTAGES & DISADVANTAGES OF USING FLOOD STORAGE DAMS FOR FLOOD RISK MANAGEMENT

Jim Heslop (jim.heslop@environment-agency.gov.uk)
Environment Agency, Northumbria Area Office, Tyneside House, Newcastle upon Tyne

This workshop will discuss the advantages and disadvantages of the use of flood storage dams in the context of Flood Risk Management and wider environmental and social benefits. It aims to draw on experiences from around the UK (including a flood storage dam constructed on the River Gaunless, Durham) and consider whether we are collectively learning lessons as schemes are proceeding. Attendees will be encouraged to contribute their experiences of such schemes either delivered or under consideration.

At Spring Gardens on the River Gaunless a project was carried out involving an on-line storage reservoir. Associated with this 11ha of wetland habitats were created, a railway path, nature trail, interpretation boards and artwork were constructed and a programme of community participation was organised. The project was taken forward in partnership with DBAP and Durham County Council, with a grant from HLF.

Groups will be asked to consider the use of food storage dams under several titles:

- What impacts are likely on geomorphological processes from on-line flood storage dams?
- What impacts are likely on wildlife and habitats from on-line flood storage dams?
- What pre & post-scheme monitoring is needed?
- What factors would indicate an on-line flood storage dam is not the right option?
- When might an on-line flood storage dam be the preferred option?
- How do we get the balance right?

Within the workshop there will be time for more general discussion, looking at the advantages and disadvantages of flood storage dams in the context of FRM strategies.

WORKSHOP 4

IS THERE A CONFLICT BETWEEN URBAN RIVER RESTORATION AND URBAN POLLUTION?

Pete Worrall (Peter.Worrall@pennyanderson.com), Penny Anderson Associates; Rebecca Wade (r.wade@abertay.ac.uk), University of Abertay Dundee.

Whilst the restoration of urban rivers is being widely promoted as a multi-benefit approach to 'greening' urban areas, questions about the potential hazards posed by these restored environments are also being raised - Do restored urban rivers pose a risk to public health and safety? What are the potential hazards associated with encouraging recreational use in areas which may contain contaminated sediments?

This workshop will examine these questions, a target product from the workshop will be construction of an 'issues' matrix for restoration of urban river systems.

Some questions for this workshop. Assuming there is a 'risk'….

- Do the benefits outweigh the risks?
- What is the best way to enable access?
- Are there ways to enable restoration but restrict access?
- Are there thresholds for acceptability for access?

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Duncan	Wishart	Jacobs UK Ltd	duncan.wishart@jacobs.com
Patrick	Woods	Haskoning UK Ltd	p.woods@royalhaskoning.com
Phil	Wormald	Environment Agency - Midlands Region	phil.wormald@environment-agency.gov.uk
Peter	Worrall	Penny Anderson Associates	Peter.Worrall@pennyanderson.com
Janice	Wotherspoon	SEPA	janice.wotherspoon@sepa.org.uk

Name		Organisation	Email
Julie	Wozniczka	University of Nottingham	wozwells@tiscali.co.uk
Patricia	Xavier	Cardiff University	xavierpa@cardiff.ac.uk
Sally	Young	Angus Council	youngsm@angus.gov.uk

Dates for your diaries:

RRC 9th Annual Network Conference

16th – 17th April 2008
Possible site visit on 18th April 2008

University of Exeter,
England

European Centre for River Restoration (ECRR)

4th International Conference on River Restoration

16th – 21st June 2008

San Servolo Island, Venezia
Italy

Workshop Allocations

Workshop 1 - Using the RBMPs and CFMPs to coordinate river restoration

Name		Organisation
Chris	Addy	Environment Agency - North West Region
Marta	Bertolaso	University Ca Foscari
Angela	Boitsidis	Jacobs UK Ltd
Rick	Bossons	Alaska Environmental Contracting Ltd
Dave	Brown	Sussex Ouse Conservation Society
Gail	Butterill	Environment Agency - North West Region
Susan	Casper	Environment Agency
Janine	Castro	River Restoration Northwest & Portland State University
Liz	Chalk	Environment Agency - North East Region
Robin	Chase	Cain Bio-Engineering Ltd
Lesley	Clarke	Environment Agency - Anglian Region
Ruth	Clarricoates	Environment Agency
David	Corbelli	Environment Agency - North West Region
Robin	Crawshaw	Environment Agency - North East Region
Jo	Cullis	Halcrow Group Ltd
Rob	Dryden	Environment Agency - Anglian Region
Kathryn	Edwards	Environment Agency - Midlands Region
Karen	Fisher	KR Fisher Consultancy Ltd
Sally	German	ARUP
Jonty	Gibson	Environment Agency - North East Region
Agata	Gieldowska	Haycock Associates Limited
Nathy	Gilligan	Office of Public Works
John	Gollan	University of New England
Jo	Goodson	Entec UK Ltd
Anthony	Green	JBA Consulting
Gareth	Greer	Rivers Agency - Northern Ireland
Oliver	Harmar	Halcrow Group Ltd
Katherine	Hearn	The National Trust
Tom	Heath	Haycock Associates Limited
Alex	Henshaw	University of Nottingham
Suzanne	Hewitt	Jacobs Babtie UK Ltd
Lorraine	Houston	RPS Consulting Engineers
Neil	Ireland	London Wildlife Trust
Martin	Janes	River Restoration Centre
Richard	Jeffries	SEPA
Jukka	Jormola	Finnish Environment Institute (SYKE)
Christopher	Lally	Department of Transport - Drainage Division
Mary-Rose	Lane	Environment Agency - South West Region
Riwilo	Masulani	Environment Agency - North East Region
Fiona	Morris	Environment Agency
Alastair	Morriss	Eden Vale-Young Associates Ltd
Ian	Morrissey	Atkins

Workshop 1 - continued

Name		Organisation
Karl	Parker	Sussex Ouse Conservation Society
Lisa	Peirce	Ecosulis Ltd
Nigel	Pilkington	Faber Maunsell Ltd
Jane	Rawson	Environment Agency - Anglian Region
Jim	Rouquette	Open University
Neil	Ryan	Environment Agency - North East Region
Jo	Shanahan	Atkins
Richard	Sharp	Environment Agency - North East Region
Ann	Skinner	Environment Agency
Colin	Thorne	University of Nottingham
Jim	Walker	Environment Agency - Head Office
Simon	Whitton	Environment Agency - Wales
Mike	Williams	Environment Agency - South West Region
Sally	Young	Angus Council

Workshop 2 - River Restoration project monitoring

Name		Organisation
Judith	Bankhead	Rivers Agency
Lindsay	Beevers	Jacobs Babtie UK Ltd
Chris	Bell	Environment Agency - Thames Region
Will	Bond	Alaska Environmental Contracting Ltd
Richard	Breakspear	Entec UK Ltd
Matt	Carter	Environment Agency - Thames Region
Elizabeth	Clements	Environment Agency - Anglian Region
Valentina	Dallafior	University Ca Foscari
Denise	Delaney	Office of Public Works
Chris	Dyson	Countryside Council for Wales
Judy	England	Environment Agency - Thames Region
Joanna	Eyquem	Haskoning UK Ltd
Martin	Fenn	Environment Agency - Midlands Region
Allan	Frake	Environment Agency - South West Region
Dominic	Funnell	RSPB Scotland
Alan	Gibson	Environment & Heritage Service Northern Ireland
David	Gilvear	Sure Limited
Ulrike	Goldschmid	City of Vienna - MA 45
Di	Hammond	Entec UK Ltd
Matthew	Hardwick	Haskoning UK Ltd
Francis	Hayes	SEPA
David	Hetherington	ARUP
Richard	Hey	University of Birmingham
Mike	Hill	Environment Agency - Thames Region
Ian	Hirst	Environment Agency - Anglian Region
David	Holland	SALIX River & Wetland Services Ltd
Nigel	Holmes	Alconbury Environmental Consultants
Katarina	Holubova	Water Research Institute

Workshop 2 - continued

Name		Organisation
Gordon	Howes	Environment Agency - Anglian Region
Rachel	Hughes	Environment Agency
Douglas	Kite	Natural England
Richard	Leishman	Natural England
Irantzu	Lexartza Artza	University of Sheffield
Jenny	Mant	River Restoration Centre
Alasdair	Matheson	SEPA
Alasdair	Maxwell	Environment Agency - South West Region
Andrea	Nardini	Centro Italiano per la Riqualificazione Fluviale (CIRF)
Marc	Naura	University of Southampton
Pam	Nolan	Environment Agency - Head Office
David	Oldmeadow	Haskoning UK Ltd
Rachael	Perryman	Environment Agency - North East Region
Neil	Punchard	Wessex Water Services Ltd
Kevin	Skinner	Jacobs UK Ltd
Russell	Spencer	Cain Bio-Engineering Ltd
Andy	Taylor	Environment Agency
Lucy	Taylor	Environment Agency - North West Region
Rhian	Thomas	Countryside Council for Wales
Mary	Toland	Environment & Heritage Service Northern Ireland
Julie	Tuck	SEPA
Andy	Went	Environment Agency - Thames Region
Glen	Wightman	Central Fisheries Board
Lorraine	Wilson	RSPB Scotland
Phil	Wormald	Environment Agency - Midlands Region
Janice	Wotherspoon	SEPA
Patricia	Xavier	Cardiff University

Workshop 3 - Advantages and disadvantages of using flood storage dams for flood risk management

Name		Organisation
Valerie	Bain	HR Wallingford Ltd
Claire	Balding	Weetwood
Amara	Barlow	Haskoning UK Ltd
Roger	Bettess	HR Wallingford Ltd
Simone	Bizzi	University of Sheffield
Lucy	Brooksbank	Jacobs UK Ltd
Matthew	Clegg	Black & Veatch Ltd
Tony	Cluskey	Environment & Heritage Service Northern Ireland
Stuart	Craxford	Environment Agency - Wales
Robert	Cunningham	RSPB
Robert	Cussen	Natural England
Richard	Dooley	Office of Public Works
Alice	Fellick	River Restoration Centre
Lidija	Globevnik	Univerza v Ljubljani

Workshop 3 - continued

Name		Organisation
Joanna	Gray	Halcrow Group Ltd
Charles	Halliday	Bath Spa University College
Jim	Heslop	Environment Agency - North East Region
Tim	Hess	Cranfield University
Liz	Horton	SEPA
Mike	Jenkins	Environment Agency - Wales
Matt	Jones	Staffordshire Wildlife Trust
Kevin	Keating	Haskoning UK Ltd
Fiona	Lang	Environment Agency - North West Region
Peter	Martin	Halcrow Group Ltd
Russ	Money	Natural England
Neil	Nutt	Halcrow Group Ltd
Carina	Oliver	Haskoning UK Ltd
Albert	Oostra	‘s-Hertogenbosch City Council
Sue	Penn	Environment Agency - North East Region
Andrew	Pepper	ATPEC River Engineering Consultancy
Charles	Perfect	Sure Limited
Alex	Radley	AXIS
Claire	Redmond	Environment Agency - Anglian Region
Brian	Rochford	Environment Agency - Thames Region
George	Roddy	Rivers Agency - Northern Ireland
Ivo	Scheffers	‘s-Hertogenbosch City Council
David	Sear	University of Southampton
Fran	Southgate	Sussex Otters & Rivers Project
Emma	Thompson	Environment Agency - Southern Region
Christie	Webster	Environment Agency - North West Region

Workshop 4 - Is there a conflict between urban river restoration and urban pollution?

Name		Organisation
Ulrika	Aberg	University of Leeds
Elly	Andison	Environment Agency - North East Region
Tiny	Arts	Municipality of Bergen op Zoom
Ruth	Bull	SORM Partnership
Paul	Chapman	London Borough of Lewisham
Lee	Church	Maccaferri Ltd
Matthew	Cook	Cranfield University
Andrew	Crawford	Environment Agency - Midlands Region
Scott	Crawford	SEPA
Anna	Curini	JBA Consulting
Helen	Dangerfield	Haskoning UK Ltd
James	Davidson	SEPA
Keli	Donnelly	SEPA
Chris	Downs	Halcrow Group Ltd
Maxine	Elliott	Environment Agency - Southern Region

Workshop 4 - continued

Name		Organisation
Ian	Frearson	Derby City Council
Colin	Gibson	Environment Agency - Head Office
Claire	Gladdy	Environment Agency - Thames Region
Anthony	Guay	Gifford Services Ltd
Nathan	Hall	Cranfield University
Nick	Hardiman	RSPB
Janine	Hensman	SEPA
Jimmy	King	Central Fisheries Board
Gunnar	Kristiansen	Norwegian Water Directorate
Zoe	Maxwell	ERM
Greg	McCleary	Environment & Heritage Service Northern Ireland
David	McKenna	Taylor Young Ltd
David	McNay	SEPA
Jon	Mellings	WWT Consulting
Gary	Morris	Environment Agency - North West Region
Damien	Nixon	Environment Agency - Southern Region
Michael	O'Kell	Chester City Council
Damien	O'Malley	Loughs Agency
Alfons	Oberhofer	Atelier Oberhofer
Graeme	Peirson	Environment Agency
Helen	Powell	Natural England
Kevin	Tozer	Derby City Council
Mark	Turner	Mersey Basin Campaign
Rebecca	Wade	University of Abertay Dundee
Kiri	Walker	SEPA
Louise	Wells	London Wildlife Trust
Geraldene	Wharton	Queen Mary, University of London
Karen	White	Atkins
Peter	Worrall	Penny Anderson Associates
Julie	Wozniczka	University of Nottingham

Site visit attendance list

Name		Organisation
Ulrika	Aberg	University of Leeds
Elly	Andison	Environment Agency - North East Region
Tiny	Arts	Municipality of Bergen op Zoom
Judith	Bankhead	Rivers Agency
Cathy	Beeching	Environment Agency - Midlands Region
Chris	Bell	Environment Agency - Thames Region
Marta	Bertolaso	University Ca Foscari
Simone	Bizzi	University of Sheffield
Angela	Boitsidis	Jacobs UK Ltd
Will	Bond	Alaska Environmental Contracting Ltd
Rick	Bossons	Alaska Environmental Contracting Ltd
Dave	Brown	Sussex Ouse Conservation Society
Gail	Butterill	Environment Agency - North West Region
Susan	Casper	Environment Agency
Janine	Castro	River Restoration Northwest & Portland State University
Lee	Church	Maccaferri Ltd
Lesley	Clarke	Environment Agency - Anglian Region
Ruth	Clarricoates	Environment Agency
Matthew	Clegg	Black & Veatch Ltd
Elizabeth	Clements	Environment Agency - Anglian Region
Andrew	Crawford	Environment Agency - Midlands Region
Robin	Crawshaw	Environment Agency - North East Region
James	Davidson	SEPA
Valentina	Dallafior	University Ca Foscari
Chris	Downs	Halcrow Group Ltd
Chris	Dyson	Countryside Council for Wales
Kathryn	Edwards	Environment Agency - Midlands Region
Maxine	Elliott	Environment Agency - Southern Region
Joanne	Evason	River Restoration Centre
Alice	Fellick	River Restoration Centre
Allan	Frake	Environment Agency - South West Region
Ulrike	Goldschmid	City of Vienna - MA 45
Gareth	Greer	Rivers Agency - Northern Ireland
Charles	Halliday	Bath Spa University College
Gerard	Hawley	Penny Anderson Associates
Richard	Hey	University of Birmingham
Mike	Hill	Environment Agency - Thames Region
Ian	Hirst	Environment Agency - Anglian Region
Katarina	Holubova	Water Research Institute
Gordon	Howes	Environment Agency - Anglian Region
Martin	Janes	River Restoration Centre
Audrey	Johnson	River Restoration Centre
Jukka	Jormola	Finnish Environment Institute (SYKE)
Jimmy	King	Central Fisheries Board
Christopher	Lally	Department of Transport - Drainage Division

Site visit attendance list - continued

Fiona	Lang	Environment Agency - North West Region
Irantzu	Lexartza Artza	University of Sheffield
Jenny	Mant	River Restoration Centre
Alasdair	Maxwell	Environment Agency - South West Region
David	McKenna	Taylor Young Ltd
David	McNay	SEPA
Ian	Morrissey	Atkins
Andrea	Nardini	Centro Italiano per la Riqualificazione Fluviale (CIRF)
Neil	Nutt	Halcrow Group Ltd
Damien	O'Malley	Loughs Agency
Karl	Parker	Sussex Ouse Conservation Society
Andrew	Pepper	ATPEC River Engineering Consultancy
George	Roddy	Rivers Agency - Northern Ireland
Kevin	Skinner	Jacobs UK Ltd
Lucy	Taylor	Environment Agency - North West Region
Emma	Thompson	Environment Agency - Southern Region
Colin	Thorne	University of Nottingham
Christie	Webster	Environment Agency - North West Region
Louise	Wells	London Wildlife Trust
Andy	Went	Environment Agency - Thames Region
Karen	White	Atkins
Glen	Wightman	Central Fisheries Board
Peter	Worrall	Penny Anderson Associates
Julie	Wozniczka	University of Nottingham

Habitat and River Restoration

AlaskA have been working in habitat and river restoration for over 25 years; almost entirely within SSSIs, usually also with SAC/SPA and Ramsar status. It is 8 years since we implemented the restoration works to the River Bollin at Manchester Airport (which will be visited by the conference field trip on Friday). Recently we have been focused on the Loch of Strathbeg in Aberdeenshire, implementing a very substantial river restoration, with associated sediment works covering another 50 ha.

The upstream end of Meander 3 on the Bollin, a year after completion.

Regraded and reseeded grassland, and new swales for sediment control and waders at Loch of Strathbeg as part of the Savoch Burn restoration project

From the contractor's perspective the Water Framework Directive is, on the one hand a great opportunity to restore rivers and water bodies on an unprecedented scale, but is also likely to be a wasted opportunity as much of the work will be rushed, and poorly performed. We look forward to working with other responsible clients, consultants and contractors to make the most of the opportunity that the WFD and other initiatives provide; building on AlaskA's reputation for thought, care and innovation.

Left: lowering reedbeds at Leighton Moss, by pumping mud over 1 km, better than running dumpers over the delicate peat surface.

Right: an amphibious excavator at work in the RSPB's Loch of Strathbeg

Rick Bossons (Contracts Manager)
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AlaskA Environmental Contracting

Will Bond (MD)
will@alaska.ltd.uk
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Stokeford Farm, East Stoke, Wareham, Dorset BH20 6AL tel: 01929 463301

This report covers 4 case studies (The Danube, Douro, Elbe and Humber). It provides summaries of the main issues relating to sediment management in these catchments.

The document can be downloaded from:

http://www.sednet.org/component/option,com_remository/Itemid,83/func,fileinfo/id,185/

Report on the SedNet Round Table Discussion

Sediment Management – an essential element of River Basin Management Plans

Venice, 22 – 23 Novemvber 2006

FEEDBACK FORM: RRC Annual Network Conference
Wednesday 18th – Thursday 19th April 2007,
Site visit on Friday 20th April 2007

University of Chester, Chester

We would appreciate it if you would spend 5 minutes filling in this form so that we can take suggestions/comments into account when organising next years Annual Conference.

1. What did you expect to learn or gain from the Conference?

2. Have your expectations of the Conference been fulfilled?

If not was it useful anyway?

3. Were the discussion sessions long enough, and frequent enough?

4. Were there any themes or topics that you would like to see presented at future Conferences?

By yourself? By others?

5. How did you hear about the Conference?

- ❑ RR News (RRC newsletter)
- ❑ Flier sent to me by email/post mailshot
- ❑ Info passed on by my colleagues
- ❑ Other (please state)……

6. Were the venue, facilities and location suitable?

If not, please comment.

And: How did the service compare to others?

7. How did you travel to the conference?

8. It is becoming more difficult to find venues in April that can accommodate this conference at realistic prices. If the RRC conference was moved to another part of the year would you still consider attending?

If yes, what months would be most suitable?

If no, please state constraints:

9. Any additional comments or suggestions

10. Some people have expressed an interest in the River Restoration Centre organising more technical based practical courses of River Restoration methods and techniques.
Is this something you would be interested in?

A) Attending? Yes/No

B) Helping, i.e. providing technical input? Yes/No

11. The RRC website has a 'Professional Service List' – an opportunity for consultants, contractors and suppliers to advertise their service.

Is this something you would be interested in subscribing to?
Yes / No

Name…….

Organisation…….

Thanks for your time