River Restoration Centre
12th Annual Network Conference

Managing Rivers at the Local and Catchment Scale

Delegate Pack

Including programme, abstracts,
site visit information and notepaper

Thursday 14th April 2011

Site visit to Croxall Lakes, Tuckers Holt Farm & Sence Valley Forest Park, Friday 15th April 2011

Jubilee Campus, University of Nottingham
England

the River Restoration Centre

Working to restore and enhance our rivers

12th Annual Network Conference

Managing Rivers at the Local and Catchment Scale

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Nick Elbourne	Information Officer		Nick@therrc.co.uk
Joanne Evason	Accounts Technician		Jo@therrc.co.uk
Di Hammond	Senior Project Advisor		Di@therrc.co.uk
James Holloway	Project Advisor	x	James@therrc.co.uk
Martin Janes	Managing Director	x	Martin@therrc.co.uk
Jenny Mant	Science & Technical Manager		Jenny@therrc.co.uk
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PROGRAMME OF EVENTS

9:00	REGISTRATION & REFRESHMENTS	
10:30	**Session 1** **CHAIR: Geraldene Wharton** *(Queen Mary, University of London & RRC Board)* Lecture Theatre 3 (LT3) - Floor D	
	Announcements: Martin Janes *(River Restoration Centre)*	5 min
10:35	**Introduction:** Geraldene Wharton *(RRC Chair of Directors)*	15 min
10:50	**Keynote address: Emerging trends in river management and restoration: An agenda for the early Twenty-first century.** Peter Downs *(University of Plymouth)*	20 min
11:10	**Discussion**	10 min
11:20	**Engaging, Supporting and Transferring Knowledge for River Restoration in Europe – the EU LIFE+ RESTORE Project.** Martin Janes *(River Restoration Centre)*	15 min
11:35	**Discussion**	5 min
11:40	SHORT BREAK TO MOVE TO SPLIT SESSIONS	20 min

Session 2:
FILLING GAPS IN KNOWLEDGE & INFORMATION RESOURCES

	A – LINKING HYDROLOGY, MORPHOLOGY AND ECOLOGY	B – NEW TOOLS FOR RESTORATION	
12:00	**CHAIR:** Peter Downs *(University of Plymouth)*	**CHAIR:** Mervyn Bramley *(Independent Engineer & Environmentalist & RRC Board)*	
	Lecture Theatre 3 (LT3) – Floor D	Lecture Theatre 2 (LT2) – Floor C	
	Using simple 2d modelling and geomorphology - habitat associations to assist in floodplain restoration. Caroline Anderton *(JBA Consulting)* et al.	**The fluvial information system: Taking river restoration into the future.** Alastair Graham and Stuart Clough *(Apem Ltd)*	15 min
12:15	**Unravelling the complexities of fish habitat interactions for successful river rehabilitation.** Michelle Smith *(University of Hull)* et al.	**Quantifying catchment-scale coarse sediment dynamics: Implications for sustainable river restoration projects.** Chris Parker *(University of the West of England)* et al.	15 min
12:30	**Discussion**	**Discussion**	15 min

12:45	LUNCH *(plus 5 minutes to move to sessions)* Foyer (Floor A) and Coffee in C33 (Floor C), with **POSTER PRESENTATIONS**	65 min

13:50	**Session 3:** **ENSURING SUCCESS**		
	A – REVIEWING ACHIEVEMENTS **CHAIR:** Kevin Skinner *(Atkins & RRC Board)* Lecture Theatre 3 (LT3) – Floor D	**B – CATCHMENT-SCALE PLANNING & IMPLEMENTATION** **CHAIR:** David Fraser *(APEM)* Lecture Theatre 2 (LT2) – Floor C	
	Assessing the impact of river rehabilitation schemes – A missing dimension or unnecessary procedure? Natalie Angelopoulos and Ian Cowx *(University of Hull).*	**The River Nar SSSI Restoration Strategy & Plan.** James Holloway and Karen Fisher *(The River Restoration Centre)*	15 min
14:05	**Rehabilitation of hydro-geomorphological processes in a lowland UK river: Quantifying and assessing the effects of large wood reintroductions.** Gemma Harvey *(Queen Mary, University of London)* et al.	**An approach to improving the empirical evidence base for biological responses to geomorphological pressures.** Chris Bromley *(SEPA)* et al.	15 min
14:20	**Post-project appraisal of the morphological and ecological performance of the Harbertonford flood alleviation scheme on the River Harbourne, Devon.** Kayleigh Wyatt and Colin Thorne *(University of Nottingham)*	**Catchment Sensitive Farming - A voluntary approach to implementing River Basin Management Plan measures in sensitive river catchments.** Alison Tytherleigh *(Natural England)* et al.	15 min
14:35	**Discussion**	**Discussion**	15 min
14:50	BREAK *(plus 5 minutes to move to sessions)* Coffee in Foyer and C33 (Floor C, with **POSTER PRESENTATIONS**)		35 min

Session 4:
THE LONG & SHORT OF IT – LONGITUDINAL & LATERAL CONNECTIVITY

	A – SEDIMENT DYNAMICS & FLOODPLAINS	B – CONTEMPORARY APPROACHES TO IN-STREAM BARRIERS	
15:25	**CHAIR:** Colin Thorne *(Univ. Nottingham)*	**CHAIR:** Andrew Pepper *(ATPEC River Engineering Consultancy & RRC Board)*	
	Lecture Theatre 3 (LT3) – Floor D	Lecture Theatre 2 (LT2) – Floor C	
	Recreating an anastomosing channel on the River Trent at Croxall Lakes. George Heritage *(JBA Consulting)* et al.	**In stream barriers assessment – A multidisciplinary approach.** Janet Shaw *(Atkins)* et al.	15 min
15:40	**A framework for hydrological connectivity management and site suitability for delivery of simultaneous ecosystem services on a floodplain.** Niko Taktikos *(Cranfield University)* et al.	**Weir removal assessment and evidence base.** Jenny Mant and Andrew Pepper *(RRC and ATPEC)*	15 min
15:55	**Targeting excessive fine sediment in rural river systems - The rural sediment tracing project.** Carolyn Mills *(APEM Ltd)* et al.	**A simple way to ease fish and eel passage across a sluice apron.** Mike Porter *(Environment Agency)* et al.	15 min
16:10	**Discussion**	**Discussion**	15 min
16:25	5 minutes to move to joint session	5 minutes to move to joint session	5 min

SESSION 5:

16:30	**Restoring rivers: The challenges of implementing whole–river plans and implications for the wider river network** Jenny Wheeldon *(Natural England)* et al.	15 min
16:45	**Discussion**	15 min
17:00	EVENING TEA C33 (Floor C) – with **POSTER PRESENTATIONS**	60 min

18:00	**Session 6:** **PARTNERSHIP WORKING & LOCAL ENGAGEMENT**	
	Announcements & Introduction	5 min
	CHAIR: Claire Thirlwall *(Thirlwall Associates)*	
	Lecture Theatre 3 (LT3) – Floor D	
18:05	**Partnerships for river restoration - More for less?** Ruth Needham *(OnTrent)* et al.	15 min
18:20	**How the Thames won the 2010 International Riverprize.** Alastair Driver *(Environment Agency)*	10 min
18:30	**Development of a Water Framework Directive-driven restoration strategy for the River Trent.** David Fraser *(Apem Ltd)* et al.	15 min
18:45	**Discussion**	5 min
18:50	MOVE TO SPLIT SESSIONS	5 min

Session 7:

	A – NOTT FAR FROM NOTTINGHAM	B – PARTNERSHIPS GREAT & SMALL	
	CHAIR: Karen Fisher *(KR Fisher Consultancy & RRC Board)*	**CHAIR:** Fiona Bowles *(Wessex Water)*	
	Lecture Theatre 3 (LT3) – Floor D	Lecture Theatre 2 (LT2) – Floor C	
18:55	**"Trout in the Town" – Urban River Restoration and Promotion by Local Community Groups.** Paul Gaskell *(Wild Trout Trust)*	**3 Rivers clean up – Ravensbourne catchment SE London - A partnership approach to invasive species removal on a catchment scale.** Victor Richardson and Matthew Blumler *(Thames 21 and QWAG)*	15 min
19:10	**Assessing the past for the future: A case study of Nottinghamshire's forgotten water meadows.** Jon Hillman *(Scott Wilson)* et al.	**Partnership works in Northern Ireland – Always start with a cup of tea.** Judith Bankhead and Gareth Greer *(Rivers Agency)*	15 min
19:25	**Restoration of riparian habitats on the old course of the River Ise in Northamptonshire.** Robin Field *(Revital-ISE)* et al.	**The role of self-help groups in river flood management.** Jonathan Simm *(HR Wallingford)*	15 min
19:40	**Discussion**	**Discussion**	20 min
20:00	------ END OF CONFERENCE ------		

ABSTRACTS

PRESENTATION SESSIONS

& POSTERS (pg 67)

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SESSION 1

Emerging trends in river management and restoration:
An agenda for the early twenty-first century

P. W. DOWNS
Associate Professor – School of Geography, Earth and Environmental Sciences,
University of Plymouth

RESTORE – Rivers: Engaging, Supporting and Transferring knOwledge for Restoration in Europe

M. D. JANES[1] & N. D. ELBOURNE[2]
[1]*Managing Director – The River Restoration Centre*
[2]*Information Officer – The River Restoration Centre*

NOTES…

EMERGING TRENDS IN RIVER MANAGEMENT AND RESTORATION: AN AGENDA FOR THE EARLY TWENTY-FIRST CENTURY

P. W. DOWNS

Associate Professor – School of Geography, Earth and Environmental Sciences, University of Plymouth
peter.downs@plymouth.ac.uk

Abstract

River management in the 1990s saw the widespread adoption of practices fundamental to the concept of 'river restoration', thus initiating a new era in the relationship between humans and their rivers. At its most elemental, river management now involves three intertwined components: water resources management, management of risk associated with near-river hazards, and conservation management practices. However, as these components have existed for thousands, hundreds, and tens of years, respectively, management initiatives are frequently centred on modifying practices for managing water resources and hazards to accommodate society's legislated concerns for conservation. In practice therefore, river restoration has usually to contend with severe pre-existing environmental degradation and catchment development pressures that will result in further cumulative impacts on the structure and function of natural ecosystems, if left unchecked.

From a viewpoint in early 2011, several themes look set to influence river management and restoration over the coming decades. First, the adoption of an ecosystem services philosophy may provide the elusive common element that allows river basin management to become truly integrated. This, in concert with the completion of the first cycle of adaptive management will lead to an increasing appreciation for 'natural infrastructure' as the basis for environmental resilience. In parallel, the governance of rivers may be achieved through a 'panarchy' of stakeholders adopting an increasingly active rather than passive approach to river conservation. Examples include the acquisition of river corridor lands funded by donations to non-government organizations, an escalating number of restoration businesses that deliver river restoration commercially in exchange for mitigation payments, and the increasing importance of river trusts as entities that can mediate between regulators, businesses and landowners to efficiently facilitate the adoption of innovative procedures. Third is an increasing appreciation that river management measures have a lifespan that precludes an assumption of environmental stationarity: whereas standard environmental impact assessments have been unable to control cumulative environmental degradation, heightened concern for global climate change may achieve just that by placing a far greater emphasis on predictive modelling of conservation concerns such as biological responses to habitat change. Finally, we may put into practice the adage that "you can't manage what you don't measure". Calls for accountability in public finances will result in a move towards evidence-based river management monitored over meaningful time periods, facilitated by recent developments in remote sensing and passive monitoring which will make feasible the extensive and intensive monitoring of environmental parameters.

Keywords: Water resources; Risk; Conservation management; Ecosystem services; Adaptive management; River stakeholders; Environmental impact; Evidence-based river management; Post-project appraisal

RESTORE – RIVERS: ENGAGING, SUPPORTING AND TRANSFERRING KNOWLEDGE FOR RESTORATION IN EUROPE

M. D. JANES[1] & N. D. ELBOURNE[2]

[1]*Managing Director – The River Restoration Centre, Cranfield Campus, Cranfield, Bedfordshire, MK43 0AL*
rrc@therrc.co.uk
[2]*Information Officer – The River Restoration Centre*

Abstract

RESTORE is an EU LIFE+ Information and Communication funded project that will develop a network linking the main target audience (MTA) of policy makers, river basin planners and a wide range of practitioners and experts across Europe. The work will share information and best practice on river restoration activities to aid implementation for EU Water Framework Directive (WFD) delivery. The project commenced in September 2010 and will finish in 2013.

RESTORE will help identify regionally common (N, E, S, W Europe) issues and constraints, and help the MTA implement environmental directives by raising their awareness of how to deliver effective river restoration. It has been identified that the main problem affecting river restoration practitioners is not a lack of expertise, but a lack of opportunities for sharing best practice and knowledge.

RESTORE addresses the need to both understand and promote best practice and it will provide the platform for effective knowledge transfer, information sharing and discussion of strengths and weaknesses of river restoration techniques and options. One way in which it will do this is by holding sector-specific engagement events, field visits and a major international conference. Another key output will be a moderated online wiki-database of case-studies highlighting lessons learnt and best practice, and also key project contacts, which will continue to operate beyond the life of the project.

The principal objectives of RESTORE are:

- Support river restoration practices across Europe
- Build up existing river restoration network capacity
- Promote effective river restoration knowledge transfer
- Establish long-term river restoration knowledge sharing

Keywords: River Restoration; Information; Communication; Policy makers; River Basin Planners; Practitioners; Stakeholders; Main Target Audience

NOTES…

SESSION 2A:

LINKING HYDROLOGY, MORPHOLOGY AND ECOLOGY

Using simple 2d modelling and geomorphology - Habitat associations to assist in floodplain restoration

C. ANDERTON *et al.*
Senior Analyst – JBA Consulting

Unravelling the complexities of fish habitat interactions for successful river rehabilitation

M.A.SMITH *et al.*
PhD student – Hull International Fisheries Institute, University of Hull

NOTES…

USING SIMPLE 2D MODELLING AND GEOMORPHOLOGY - HABITAT ASSOCIATIONS TO ASSIST IN FLOODPLAIN RESTORATION

C. ANDERTON[1], G. L. HERITAGE[2], L. HICKS[3], S. MCFARLAND[4] & S. COOKSLEY[5]

[1]*Senior Analyst – JBA Consulting, Port Neuk, Longcraig Road, South Queensferry, Edinburgh EH30 9TD*
Caroline.Anderton@JBAConsulting.co.uk
[2]*Technical Director – JBA Consulting, The Brew House, Wilderspool Park, Warrington WA4 6HL*
[3]*Senior Analyst – JBA Consulting, Denison House, Hexthorpe Road, Doncaster, South Yorkshire DN4 0BF*
[4]*Principal Engineer – Aberdeenshire Council, Carlton House, Arduthie Road, Stonehaven AB39 2DP*
[5]*Project Officer – Dee Catchment Partnership, The Macaulay Institute, Aberdeen AB10 1YP*

Abstract

The reinstatement of channel and floodplain process alongside that of form is recognised as fundamental for sustainable river restoration. Opportunities often exist to restore functionality across floodplains that have suffered from hydrological and sediment disconnection as a result of flow regime changes and physical flood protection measures. However, engineered approaches to habitat creation often dominate over assisted natural recovery options. This paper demonstrates a simple methodology to identify natural floodplain features and to predict the ecological gains generated by their restoration on the River Dee upstream of Braemar, Royal Deeside.

Identification of palaeo-features present across the floodplain was initially achieved using aerial imagery, facilitating targeted field survey of their geomorphology and ecology. Linked data from the two surveys allowed empirical associations to be established. A 2D cellular based inundation model (JFLOW) was used to model surface water flood extent and frequency based on an aerial LiDAR digital terrain model and flows from the Mar Lodge gauging station. This established the present flood regime and the potential regime following selective defence removal. Associations between the present flood regime, morphological features and vegetative assemblages were then established and these were transferred to the modelled scenarios to predict altered floodplain community structure.

It is clear from the results for the River Dee simulations that floodplain geomorphological diversity is high but process diversity is low due to poor hydrological connectivity. Process diversity is seen to increase dramatically once flood connectivity is re-established. Palaeo-features presently subject to a flood-poor relatively uniform over-dry hydrological regime become subjected to spatially variable flood flows dependent on proximity and connectivity to the active channel network. This diversity in form and process recreates floodplain physical habitats lost to the system providing conditions for the spread of species previously highly restricted in their distribution.

Keywords: Hydromorphology; LiDAR; Floodplain features

UNRAVELLING THE COMPLEXITIES OF FISH HABITAT INTERACTIONS FOR SUCCESSFUL RIVER REHABILITATION

M.A.SMITH[1], N.ANGELOPOULOS[2], T.COULTHARD[3] AND I.G.COWX[4]

[1]*PhD student – Hull International Fisheries Institute, University of Hull, East Yorkshire HU6 7RX*
m.a.smith@biosci.hull.ac.uk
[2]*Research Assistant – Hull International Fisheries Institute, University of Hull, East Yorkshire*
[3] *Professor of Physical Geography – University of Hull, East Yorkshire*
[4] *Professor of Applied Fisheries Science – University of Hull, East Yorkshire*

Abstract

European rivers require considerable intervention to meet the Water Framework Directive objectives of Good Ecological Status / Potential. To achieve this, attention is now focussing on the ecological impacts of hydromorphological degradation of rivers. River hydromorphology, driven by river flow and through a complex interaction between physical characteristics including substrate, depth and channel width, creates a variety of physical conditions. Although it is recognised that there is a relationship between physical habitat and aquatic communities very few studies make the link between physical habitat conditions and fish community structure. These interactions create diversity in physical habitat for all life stages of fish, which are reflected by community structure.

If river rehabilitation is to be successful, the consequences of modifying (improving) in-stream physical characteristics through active intervention on all life stages of fish needs to be fully understood. This paper examines the importance of major physical habitat variables to fish species through a series of case studies from a variety of rivers across the UK. Methods of assessing physical habitat will be discussed paying particular attention to the practical applications of these methods in terms of river restoration and providing useful outputs for managers.

Keywords: Water Framework Directive; Hydromorphology; Habitat

NOTES…

SESSION 2B:

NEW TOOLS FOR RESTORATION

The fluvial information system: Taking river restoration into the future

A.J. GRAHAM[1] & S. CLOUGH[2]

[1]*Senior Remote Sensing Scientist – APEM*

[2]*Director – APEM Remote Sensing*

Quantifying catchment-scale coarse sediment dynamics: Implications for sustainable river restoration projects

CHRIS PARKER *et al.*

Senior Lecturer of Physical Geography – Department of Geography and Environmental Management, University of the West of England

NOTES…

THE FLUVIAL INFORMATION SYSTEM: TAKING RIVER RESTORATION INTO THE FUTURE

A.J. GRAHAM[1] & S. CLOUGH[2]

[1]*Senior Remote Sensing Scientist – APEM Remote Sensing, APEM Manchester Lab, Riverview, A17 Embankment Business Park, Heaton Mersey, Stockport SK4 3GN* A.Graham@apemltd.co.uk
[2]*Director – APEM Remote Sensing, APEM Manchester Lab, Stockport*

Abstract

River experts understand that our knowledge of ecology and geomorphology is limited by our lack of methods applicable to catchment scale processes. The EU Water Framework Directive states that surface waters must be managed at catchment scales and this has created a need for a new approach to high-resolution catchment scale data collection in fluvial environments. Remote Sensing has developed techniques that enable the mapping of parameters such as water depth, grain size and habitat type with sub-metric resolutions over large areas. With greatly increased levels of information now available to them, river and fisheries managers can make better informed data-driven decisions about catchment scale ecology and geomorphology. Extracting spatially explicit information from large image databases poses a significant challenge which must be resolved if fluvial remote sensing methods are to deliver their potential.

Here we detail the Fluvial Information System (FIS), a raster based GIS-type system designed to manage fluvial remote sensing data and automatically extract meaningful information. Using aerial imagery within such a system allows river restoration experts to identify critical obstacles to effective naturalised flow: sediment traps, canalisation, flood plain connectivity etc. The power of the FIS rests on its 2D river coordinate system modelled on a system that follows the river path as calculated by curve fitting whilst the cross-stream direction is locally orthogonal to the main axis and is know as the river coordinate system. Further enhancements in the FIS are innovative visualisation methods for the depth and clast size data that is computed.

This adaptation of GIS to fluvial systems is a significant innovation with consequences to fundamental river science and management. Once the restoration requirements have been identified, the FIS (in conjunction with timely aerial data capture) can be used to monitor the effectiveness and progress of any remedial works that have been enacted. With the FIS, managers can make use of the information contained in high resolution imagery to allow stakeholders to quantify the available habitat for important species such as salmonids and in the support of river management decisions. The value of the FIS will be demonstrated through the use of key example projects undertaken by APEM.

Keywords: River depth; Remote sensing; Sediment mapping; GIS; Spatial modelling

QUANTIFYING CATCHMENT-SCALE COARSE SEDIMENT DYNAMICS: IMPLICATIONS FOR SUSTAINABLE RIVER RESTORATION PROJECTS

CHRIS PARKER[1], COLIN R. THORNE[2] & NICHOLAS. J. CLIFFORD[3]

[1]*Senior Lecturer of Physical Geography – Department of Geography and Environmental Management, University of the West of England, Bristol* Chris2.Parker@uwe.ac.uk
[2]*Professor of Physical Geography – School of Geography, University of Nottingham*
[3]*Professor of Physical Geography – Department of Geography, King's College London*

Abstract

The transfer of coarse sediment within the fluvial system exerts an important influence over physical habitat structures within rivers which, in turn, are a key control over river ecology. It follows that sustainable and effective river restoration design depends on understanding coarse sediment dynamics within the fluvial system. As a result, catchment-scale river channel sediment dynamics must be taken into account within river restoration projects as well as flood risk management projects. Yet, due to limitations on data describing British rivers, no existing approach to representing coarse sediment dynamics is both scientifically robust and utilizable at the catchment-scale.

A new reach-based sediment balance model has been developed, called ST:REAM (Sediment Transport: Reach Equilibrium Assessment Method). ST:REAM is functional using no more than slope, width and discharge data that are widely available in British rivers. The outputs from ST:REAM are in the form of predicted CSRs (Capacity Supply Ratios) which compare the mass of sediment predicted to enter a reach with the mass of sediment predicted to leave that reach.

ST:REAM has many potential applications within British river management, these include: providing an indication of reaches with poor hydromorphological status due to sediment imbalance; identifying the impact of proposed restoration plans on catchment sediment transfer; and identifying reaches of channel that pose significant flood risk due to excessive deposition. However, because of the scale at which it represents sediment dynamics, ST:REAM is of most value when providing a broad-scale picture of predicted reach sediment status across a catchment.

Of additional relevance to river restoration practitioners is the method used to automatically define reach boundaries within ST:REAM. It has the potential to identify river reach boundaries that are relevant across various aspects of the fluvial system, and that therefore can act as a relevant spatial framework for integrated catchment management.

Keywords: Geomorphology; Catchment management; Flood risk

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SESSION 3A:

REVIEWING ACHIEVEMENTS

Assessing the impact of river rehabilitation schemes –
A missing dimension or unnecessary procedure?

N. ANGELOPOULOS *et al.*
Research Assistant – Hull International Fisheries Institute, University of Hull

Rehabilitation of hydrogeomorphological processes in a lowland UK river: Quantifying and assessing the effects of large wood reintroductions

GEMMA L. HARVEY *et al.*
Lecturer in Physical Geography – Queen Mary, University of London

Post-project appraisal of the morphological and ecological performance of the Harbertonford flood alleviation scheme on the River Harbourne, Devon

KAYLEIGH WYATT[1] & COLIN THORNE[2]
[1]*Student: MSc Environmental Management – University of Nottingham*
[2]*Professor and Chair of Physical Geography – Univ. of Nottingham*

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ASSESSING THE IMPACT OF RIVER REHABILITATION SCHEMES – A MISSING DIMENSION OR UNNECESSARY PROCEDURE?

N. ANGELOPOULOS[1], M. A SMITH[1] & I. G. COWX[2]

[1]*Research Assistants – Hull International Fisheries Institute, University of Hull, East Yorkshire HU6 7RX*
n.angelopoulos@biosci.hull.ac.uk
[2]*Professor of Applied Fisheries Science – University of Hull, East Yorkshire. HU6 7RX*

Abstract

Developing environmentally acceptable methods for river rehabilitation is now a fundamental requirement to meet objectives under the EU Water Framework Directive (WFD) and Habitats Directive. Although literature on restoration ecology is extensive, it remains fragmented and rarely is the success, or other findings of projects assessed to determine the efficacy of the projects to meet these objectives. One of the reasons for this failure is lack of clearly defined end-points against which to measure success. This lack of effort is a serious impediment for managers who have to make decisions on the most cost-effective restoration measures to address hydrogeomorphological degradation in different river types. The objective of this contribution is to review the findings of a range of rehabilitation schemes on different rivers across England to establish a procedure to assess the efficacy of rehabilitation schemes and enable managers to choose the most cost effective measures for various scenarios.

The paper will provide an integrated approach to project planning that deals with both the variability of river rehabilitation and complexity of an ecosystem. Restoration projects should not be selected at random and therefore, it is essential that any future rehabilitation scheme must follow a framework that firstly prioritises projects and secondly identifies multiple objectives. These objectives should work towards benefiting fish communities, taking in to account the needs of individual fish species and size class, to recognise the 'missing' habitat and identify the habitat enhancement technique needed. Measuring project success can be challenging but nevertheless it is imperative to include pre-assessment, short-term and long-term monitoring in to the framework. The challenges for future monitoring will be addressed with ideas to overcome the difficulties of comparing rehabilitation effectiveness across rivers.

Keywords: Water Framework Directive; Habitats Directive; Restoration; Hydrogeomorphology; Monitoring

REHABILITATION OF HYDROGEOMORPHOLOGICAL PROCESSES IN A LOWLAND UK RIVER: QUANTIFYING AND ASSESSING THE EFFECTS OF LARGE WOOD REINTRODUCTIONS

GEMMA L. HARVEY[1], ALEXANDER J. HENSHAW[2], CHRIS PARKER[3], CARL SAYER[4] & MURRAY THOMPSON[5]

[1]*Lecturer in Physical Geography – Queen Mary, University of London, London* g.l.harvey@qmul.ac.uk
[2]*Postdoctoral Research Fellow – University of Nottingham, Nottingham*
[3]*Senior Lecturer in Physical Geography – University of the West of England, Bristol*
[4]*Lecturer in Physical Geography – University College London, London*
[5]*PhD student – Natural History Museum, London*

Abstract

Large pieces of wood, including entire fallen trees, are a natural feature of many river systems and have been shown to be an important control on river morphology, sediment retention and the construction of habitats. Wood can act as an 'ecosystem engineer' in river channels by modifying local geomorphic, hydraulic, and sedimentological processes, increasing habitat diversity and potentially sustaining water quality. However, within Europe and particularly the UK, wood has been perceived as a flood hazard and, consequently, lowland rivers have been subject to routine clearance of large wood in order to improve flow conveyance. Reintroductions of large wood increasingly features in river rehabilitation projects, but, despite considerable research activity in this area, many practical attempts to input large wood features into river channels have incorporated costly engineered structures, which have often been ineffective in improving habitat heterogeneity and biodiversity. Further research is required to improve understanding of the nature and extent of the impacts of large wood on habitat complexity and connectivity in order to inform river rehabilitation practice.

A research programme has been initiated that aims to characterize and quantify changes in hydromorphological processes and habitat complexity following wood reintroduction. This will be achieved through detailed field study incorporating comparisons between adjacent reaches and monitoring of changes over time. The field study is based upon selected reaches of the upper River Bure, Norfolk, where a programme of large wood reintroduction is being undertaken by the National Trust. It is anticipated that the research findings from this project will contribute to the evidence base for wood-related flood risks in lowland UK rivers by monitoring the mobility of wood assemblages, assessing stage-discharge relationships and exploring the influence of wood assemblages on fine sediment storage and transfer in a low energy system.

Keywords: River Bure; Wood; Large woody debris; Habitat; Sediment; Flood risk; Hydraulics

POST-PROJECT APPRAISAL OF THE MORPHOLOGICAL AND ECOLOGICAL PERFORMANCE OF THE HARBERTONFORD FLOOD ALLEVIATION SCHEME ON THE RIVER HARBOURNE, DEVON

KAYLEIGH WYATT[1] & COLIN THORNE[2]

[1]*Student: MSc Environmental Management – University of Nottingham, c/o Sir Clive Granger Building, University Park, Nottingham, NG7 2RD* lgxkw@nottingham.ac.uk

[2]*Professor and Chair of Physical Geography – Univ. of Nottingham, Room B26f, Sir Clive Granger Building*

Abstract

The River Harbourne flood alleviation scheme (FAS) was implemented in 2002, with the objectives of reducing flood risk in the village of Harbertonford and limiting the need for channel maintenance, while simultaneously promoting the environmental and conservational value of the watercourse. Commenting on the scheme, Sir John Harman, the then Chair of the Environment Agency, described the project at Harbertonford as representing 'the future of flood defence schemes' in England and Wales.

In the context of this statement, this paper evaluates the morphological and ecological performance of the FAS based on the results of a series of post-project appraisals (PPAs) performed since its implementation. Channel morphology was assessed using stream reconnaissance techniques and cross-sectional surveys, while stream and riparian ecology was investigated using river habitat survey (RHS) data, diatom sampling, benthic macro-invertebrate sampling and vegetation surveys.

Statistical analyses of the morphological and ecological data reveal that the Harbourne is a highly dynamic watercourse that is still responding to implementation of the FAS. There is evidence that rates of gravel accumulation in the Harbourne within Harbertonford have been reduced by channel improvements undertaken as part of the FAS. In terms of ecological value, positive changes were concentrated in wetlands created in the footprint of the flood storage area upstream of the settlement, while negative changes were found in reaches located downstream of Parker Dam and in the extensively modified channel in the downstream reaches of the FAS.

In summary, although morphological and ecological responses to the FAS on the River Harbourne are continuing, and while the project can be judged as a success to date, the lessons so far learned through PPAs of this high profile scheme could and should be considered in the design of similar schemes proposed for other watercourses throughout the UK.

Keywords: Flood risk; Channel modification; Stream reconnaissance; River Habitat Survey; Diatom sampling; Macroinvertebrate sampling; Vegetation sampling

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SESSION 3B:

CATCHMENT-SCALE PLANNING & IMPLEMENTATION

The River Nar Restoration Strategy and Plan – From sketch to implementation

J. V. HOLLOWAY[1] & K. R. FISHER[2]

[1]*Projects Adviser – The River Restoration Centre*

[2]*Director – KR Fisher Consultancy*

An approach to improving the empirical evidence base for biological responses to geomorphological pressures

C. BROMLEY *et al.*

Senior Hydromorphologist - Ecology Partnership & Development Unit, SEPA

Catchment Sensitive Farming - A voluntary approach to implementing River Basin Management Plan measures in sensitive river catchments

A.R.J. TYTHERLEIGH *et al.*

Delivery Manager – England Catchment Sensitive Farming Delivery Initiative, Natural England

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THE RIVER NAR RESTORATION STRATEGY AND PLAN - FROM SKETCH TO IMPLEMENTATION

J. V. HOLLOWAY[1] & K. R. FISHER[2]

[1]*Projects Adviser – The River Restoration Centre, Cranfield Campus, Cranfield, Bedfordshire, MK43 0AL*
rrc@therrc.co.uk
[2]*Director – KR Fisher Consultancy*

The River Nar originates as a spring-fed stream west of Mileham in Norfolk, and discharges into the Great Ouse 42 km downstream at King's Lynn. The river has been designated as a Site of Special Scientific Interest (SSSI), and supports a range of important Biodiversity Action Plan habitats, including chalk stream areas, fens, wet meadows and woodlands. The two distinct parts of the river are managed separately: the upper 'classic chalk stream' by the Norfolk Rivers Internal Drainage Board (IDB, part of the Water Management Alliance); and the lower 'fen drain' by the Environment Agency (EA).

In 2004/5, the SSSI being in 'unfavourable condition', Natural England commissioned a Fluvial Audit on the Nar SSSI (Sear et al, 2006), in partnership with the EA and the IDB. The Drainage Board undertook a study in early 2008 into the Water Control Structures in the Upper Nar, and a similar study on structures in the Lower Nar by the EA was completed in April 2009 (Fisher et al, 2009). Natural England was keen that the next step was to produce a river restoration plan for the whole of the River Nar, as a 'remedy' under the Government's Public Service Agreement (PSA3) to bring 95% of all SSSIs in England into favourable condition by the end of 2010. The project was led by the IDB in partnership with the EA, with major inputs from RRC and KR Fisher Consultancy.

The River Nar Restoration Strategy and Plan presents measures for improving the status of the river, with benefits for wildlife, recreation, flood risk, water quality and the landscape, by:

- Presenting a complete assessment of the current state of the river, drawing together all currently available information and findings of a dedicated survey;
- Development of a vision of the ideal future condition of the Nar;
- Identification of the issues which need to be addressed in order to realize this vision;
- Presentation of solutions to these issues both on a whole river and a reach-by-reach scale, while highlighting the major constraints on what can be implemented and suggesting delivery mechanisms by which some of these solutions may be achieved.

The plan also identified five pilot projects and three of these were implemented last month.

This presentation explores the process undertaken in producing the strategy including: developing the vision; establishing the team; the walkover survey and consultation with stakeholders and the wider public. The successes and problems encountered within the project process will be discussed, including the delivery of pilot projects and some of the challenges for the future.

Keywords: SSSI; Protected area objectives; Water Framework Directive; Ecologically-based restoration visions

AN APPROACH TO IMPROVING THE EMPIRICAL EVIDENCE BASE FOR BIOLOGICAL RESPONSES TO GEOMORPHOLOGICAL PRESSURES

C. BROMLEY[1], F. CARSE[2], W. DUNCAN[3]

[1]*Senior Hydromorphologist - Ecology Partnership & Development Unit, Scottish Environment Protection Agency, Chris.Bromley@sepa.org.uk*
[2] *Senior Environmental Modeller & Data Analyst, Environmental Assessment Unit, , Scottish Environment Protection Agency*
[3] *Unit Manager - Ecology Partnership & Development Unit, Scottish Environment Protection Agency*

Abstract

The overall aim of the Water Framework Directive (WFD) is to improve the structure and functioning of aquatic ecosystems, with a view to protecting and enhancing the living components of those systems. The condition of biological quality elements (BQE) (fish, invertebrates, macrophytes and phytobenthos and phytoplankton) must therefore be classified into one of five ecological status categories (High, Good, Moderate, Poor or Bad). The condition of the hydrological and geomorphological quality elements must be classified and reported on to Europe only when they are at High status; below this, they must only be of sufficient quality to support the BQE conditions at the specified ecological status classes. This nevertheless requires that the absolute condition of the hydrology and geomorphology is known since, if it is not, it is not possible to determine whether or not it is providing the required level of support. Ideally, the level of support would be assessed through biological classification tools that are sensitive to these quality elements, but these tools are not yet available.

The development of geomorphologically-sensitive biological classification tools is currently hindered by an insufficiently detailed understanding of how biology responds to geomorphological pressures. The UK Technical Advisory Group (UKTAG) has told the environment agencies that they must develop a greater empirical understanding of these interactions as an intermediate step towards the development of the required tools. An approach to improving the empirical knowledge base has been identified and is described. In essence, it is a hypothesis-driven examination of existing literature, existing biological and geomorphological datasets, and collection of new biological and geomorphological data. Hypotheses are developed based on detailed considerations of the mechanisms by which certain kinds of geomorphological channel modifications impact geomorphological processes and the ways in which in-channel biota will subsequently be impacted. Biological and geomorphological data must be collected at spatial and temporal scales that will allow the details of these mechanisms to be quantified.

Keywords: Water Framework Directive; Biological Quality Elements; Mechanisms; Hypotheses; Literature review; Data re-analysis; Data collection; Scale

CATCHMENT SENSITIVE FARMING - A VOLUNTARY APPROACH TO IMPLEMENTING RIVER BASIN MANAGEMENT PLAN MEASURES IN SENSITIVE RIVER CATCHMENTS

A.R.J. TYTHERLEIGH[1], P. SMITH[2] & A.J. BURN[3]

[1]*Delivery Manager – England Catchment Sensitive Farming Delivery Initiative, Natural England, Exeter EX4 3AW* Alison.Tytherleigh@naturalengland.org.uk
[2]*Evidence Manager – Catchment Sensitive Farming, Environment Agency, Preston PR5 8BX*
[3]*Principal Specialist, Freshwater and Pollution – Natural England, Peterborough PE1 1XN*

Abstract

In 2003 the then English Nature reported that diffuse agricultural pollution was of widespread concern in England, with 72 of 156 (46%) of English river catchments containing SSSIs considered to be impacted by or at risk from diffuse agricultural pollution (English Nature report 551 – 2003), eutrophication being a particular problem. In addition to nutrient and soil particle pollution, organic pollution from farms remains a serious issue for many river SSSIs. More recent estimates from the Environment Agency's Water Framework Directive evidence, suggest that approximately 40% of water bodies in England are failing to meet Good Ecological Status with agriculture (sediments, nutrients and pesticides) cited as a major factor and the resulting environmental damage costing between £322 - £627m per annum.

Between 2006 and 2011 the England Catchment Sensitive Farming Delivery Initiative (ECSFDI), a partnership project between Defra, the Environment Agency and Natural England, has had the primary aim of reducing diffuse water pollution from agriculture (DWPA) within 50 priority catchments across England using a voluntary approach. The ECSDFI is a key measure included in River Basin Management Plans to reduce DWPA.

The achievements of the ECSFDI Phases 1 and 2 will be presented, focusing around four strategic objectives:

- Farmer engagement and awareness, including the key lessons learnt from the range of approaches adopted by Catchment Sensitive Farming Officers and the use of local evidence.
- The uptake of voluntary action to mitigate DWPA by farmers.
- The contribution to Water Framework Directive requirements through water quality modelling and monitoring.
- The synergy and integration with related stakeholder programmes and approaches to tackling DWPA demonstrated through National and Regional Strategic Partnerships, including linking with the Nitrate Vulnerable Zones advice programme, Environmental Stewardship, the Environment Agency's new approach to catchment based planning and Defra's Demonstration Test Catchments.

Other actions proposed for Phase 3 of the CSF project (2011 to 2013) and those needed to achieve the necessary changes in land management will be discussed, as well as requirements to deal with other sources of pollution including small, un-consented point sources.

Keywords: Agriculture; Diffuse water pollution; Incentives; Advice; ECSFDI; Freshwater, stakeholder engagement.

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SESSION 4A:

SEDIMENT DYNAMICS AND FLOODPLAINS

Recreating an anastomosing channel on the River Trent at Croxall Lakes

G. L. HERITAGE *et al.*
Technical Director – JBA Consulting

A framework for hydrological connectivity management and site suitability for delivery of simultaneous ecosystem services on a floodplain

N. TAKTIKOS *et al.*
Postgraduate Researcher – Cranfield University

Targeting excessive fine sediment in rural river systems - The rural sediment tracing project

C. MILLS *et al.*
Aquatic Scientist – APEM

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RECREATING AN ANASTOMOSING CHANNEL ON THE RIVER TRENT AT CROXALL LAKES

G. L. HERITAGE[1], N. S. ENTWISTLE[2] & R. KIBBLE[3]

[1]*Technical Director – JBA Consulting, The Brew House, Wilderspool Park, Greenall's Avenue, Warrington WA4 6HL George.Heritage@JBAConsulting.co.uk*
[2]*Lecturer – Built and Human Environment Research Institute, Salford University, Manchester*
[3]*Masters student – Built and Human Environment Research Institute, Salford University, Manchester*

Abstract

The tendency of the River Trent and its principal tributaries to split to create gravel shoals and larger stable islands has been noted by a number of previous studies, and the resultant geomorphic variability is seen as very important from a biodiversity perspective. This is particularly the case as the river is highly modified with long sections of the river now stable, morphologically uninteresting and unconnected with their floodplain.

The process of shoaling, bar and island development is primarily controlled by flow transport variation with wider shallower reaches exhibiting sediment build up. Such reduced energy zones may be artificially created through channel widening, scalping the floodplain silts to expose the gravels beneath and allowing the river to rework this material together with any inputs delivered from upstream.

Staffordshire Wildlife Trust has widened the channel of the Trent in the vicinity of the confluence of the River Tame removing approximately 45,000 m^3 of floodplain deposits. Segmented 1D flow modelling based on surveyed cross-sections and terrestrial LiDAR survey data suggested that a multiple channel variable height island configuration would maximise hydromorphic diversity through the reach and maintain fine sediment transport through the majority of channels during elevated flows. This pattern was followed during excavation. Excavated gravels were retained and island areas left undredged to create a series of interconnecting shallow channels. Gravel shoaling and island development is being further encouraged through the creation of large woody debris deposits.

A hydromorphological audit of the site after one winter flow season reveals a high flow diversity with variable erosion and deposition creating a complex pattern of biotopes. Large woody debris has trapped gravels and additional vegetation, encouraging island formation and gravel shoals have remained largely sediment free.

Keywords: Hydromorphology; Geomorphology; Floodplain; Anastomosed; Upland river

A FRAMEWORK FOR HYDROLOGICAL CONNECTIVITY MANAGEMENT AND SITE SUITABILITY FOR DELIVERY OF SIMULTANEOUS ECOSYSTEM SERVICES ON A FLOODPLAIN

N. TAKTIKOS[1], T.M. HESS[2] & A.B. GILL[3]

[1]*Postgraduate Researcher – Cranfield University, Natural Resources Department, School of Applied Sciences, College Road, Cranfield, Bedfordshire MK43 0AL* niko.taktikos@cranfield.ac.uk
[2]*Reader in Water Management – Cranfield University, Natural Resources Department*
[3]*Lecturer in Aquatic Ecology – Cranfield University, Natural Resources Department*

Abstract

A river floodplain is one of many distinctive landscapes that can provide a range of multiple ecosystem services due to their environmental characteristics. Throughout the course of history, society has derived socio-economic benefits from this landscape and ecosystem e.g. agriculture, habitation and recreation.

Anthropogenic activity has led to unprecedented alteration and modification of this landscape. While such changes have led to improvements in the quality of life, accelerating human needs have concomitantly weakened and degraded the floodplains' natural capacity to deliver and provide benefits. Past management of floodplains placed emphasis on a single ecosystem service that can impact on the supply of other services. The value of the floodplain ecosystem is largely underestimated and the challenge remains to protect the ecosystem for the provision of well-being as part of sustainable development.

This research aims to provide a framework for the management of river floodplain hydrological connectivity and site suitability to deliver simultaneous ecosystem services. Combined 1D/2D hydrodynamic and water balance models are used to simulate hydrological connectivity and seasonality scenarios. The output of these scenarios will be utilized to assess the potential for synergy and conflict amongst the identified floodplain hydrology based ecosystem services. A range of contrasting case study sites based within the Lower Bedford Ouse, UK, demonstrate how site characteristics can influence the delivery of hydrology based ecosystem services.

Keywords: Floodplain; Ecosystem services; Hydrological connectivity; Models

TARGETING EXCESSIVE FINE SEDIMENT IN RURAL RIVER SYSTEMS - THE RURAL SEDIMENT TRACING PROJECT

C. MILLS[1], P. DENNIS[2], R.P. SMITH[3] & D.C. BRADLEY[4]

[1]*Aquatic Scientist – APEM Ltd., Riverview, A17 Embankment Business Park, Heaton Mersey, Stockport SK4 3GN* c.mills@apemltd.co.uk
[2]*Senior Aquatic Ecologist – APEM Ltd., Heaton Mersey, Stockport*
[3]*Principal Officer, Land Quality – Environment Agency, Manley House, Kestrel Way Exeter, Devon, EX2 7LQ*
[4]*Principal Aquatic Ecologist – APEM Ltd., Heaton Mersey, Stockport*

Abstract

Excessive fine sediment is recognised as a limitation to the attainment of good ecological status, or potential, by rivers in England as required by the Water Framework Directive (WFD). However, an evidence base for the scale and magnitude of the problems associated with excessive fine sediment inputs in English river catchments is lacking. To address this, in 2009 the Environment Agency (EA) initiated the Rural Sediment Tracing Project. The aims of the project were: i) to devise a standardised walkover survey methodology, complimented by aerial surveillance; and ii) to use this methodology to identify and classify sources of fine sediment inputs to streams and rivers in 11 catchments in rural areas across England. Excessive inputs of fine sediment were known to be a problem in the selected rivers, which also support valuable populations of Atlantic salmon.

Walkover surveys of up to 300 km of river length were performed in each catchment by teams of field scientists. Potential sediment sources were mapped and graded according to their severity and origin, using a standardised methodology developed by APEM. In four catchments the most severe sources were revisited during high magnitude rainfall events and water samples were collected to quantify the concentrations of suspended solids upstream, downstream and at the source of sediment inputs during runoff events. Aerial surveillance was carried out following wet weather, to provide further evidence of sediment sources.

The ambitious survey generated an unprecedented data set, which identified sediment from agricultural sources as the major contribution to the problem of excessive fine sediment in these catchments. The dominant types of fine sediment source were from livestock poaching and runoff from arable land. In addition, sediment runoff from roads, tracks, field drains and bank works constituted a significant input in most of the catchments surveyed. The severity of fine sediment input in a given catchment was found to be dependent on the intensity of agriculture in combination with the underlying erosion risk of the soil.

Potential ecological damage, often in the form of sedimentation of valuable salmonid habitat, was observed in every catchment. Within catchments there were often specific tributaries or localised areas where the effects of excessive fine sediment were most obvious. We discuss the results of the survey and their implications for the restoration of riverine habitats. The survey results provide the basis for a targeted approach to tackling the problem of elevated fine sediment levels at source by identifying the specific areas that are contributing most to the problem in each catchment.

Keywords: Agricultural runoff; diffuse pollution; Water Framework Directive

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SESSION 4B:

CONTEMPORARY APPROACHES TO IN-STREAM BARRIERS

In stream barriers assessment – A multidisciplinary approach

J. SHAW *et al.*
Environmental Scientist – Atkins

Weir removal assessment and evidence base

J. MANT *et al.*
Science & Technical Manager – The River Restoration Centre

A simple way to ease fish and eel passage across a sluice apron

M. PORTER *et al.*
Project Officer – Environment Agency, South West Region

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IN STREAM BARRIERS ASSESSMENT – A MULTIDISCIPLINARY APPROACH

J. SHAW[1], K. SKINNER[2], A. HUMPHREYS[3] & R. SEWELL[4]

[1]*Environmental Scientist – Atkins, The Hub, 500 Park Avenue, Atzec West, Almondsbury, Bristol, BS32 4RZ* Janet.Shaw@atkinsglobal.com

[2]*Principal Consultant, Hydromorphology and River Restoration/Management – Atkins, Oxford*

[3]*Senior Engineer, Rivers and Coastal – Atkins, Swansea*

[4]*Assistant Environmental Scientist, Rivers and Coastal – Atkins, Glasgow*

Abstract

Instream barriers are a major obstacle for fish migration. The removal or modification of these structures is widely seen as a substantial environmental gain in the first round of River Basin Management Plans under the Water Framework Directive (WFD). Large scale surveys undertaken by the various statutory authorities have identified the location of many of these structures around UK rivers. For example, the Environment Agency has estimated that there are approximately 26,000 of these features throughout England and Wales. The current challenge is to prioritise catchments and to assess the identified structures to establish whether it is both technically and practically feasible to remove or modify them to improve the hydromorphological and ecological functioning of the river system.

This paper presents a multidisciplinary, integrated barrier assessment methodology that has been developed by Atkins and successfully applied on 40 sites for the Environment Agency and the Scottish Environment Protection Agency (SEPA). The rapid-style assessments included desk-based study and a site visit. Importantly, a range of linked factors were considered at each site. These included environmental factors such as terrestrial ecology, fisheries, hydromorphology and human-related factors such as engineering design and site access. Baseline conditions for each were recorded at the barrier sites themselves, and also along the upstream and downstream reaches to estimate the spatial zones over which the barrier was currently having an impact. This information was used as the basis for consultation within the Atkins team and with the client to identify the most suitable management option for each barrier based on potential risks versus environmental benefits and technical feasibility. The options considered included i) do-nothing, ii) full removal, iii) partial removal, iv) formal fish pass and v) an informal or easement-type fish pass. After appraising each of the options and considering the technical feasibility of structural works, costs and impacts on flooding, an option was recommended and monitoring and mitigation recommendations were made. In certain cases, additional assessment works were recommended for the detailed design phase. For each barrier, the data and accompanying assessment were presented in a simple, structured format with photographs to provide a consistent and user-friendly output to the client and stakeholders.

The paper also presents case studies from the projects and examines the main constraints to recommending the WFD preferred option of full barrier removal. Alternative options that could be scoped into the works are also discussed.

Keywords: Water Framework Directive; Fish passage; Fish pass; Barrier removal; Barrier modification; Options appraisal; Integrated approach

WEIR REMOVAL ASSESSMENT AND EVIDENCE BASE

J. MANT[1], N. D. ELBOURNE[2] & A. T. PEPPER[3]

[1]*Science & Technical Manager – The River Restoration Centre, Cranfield Campus, Cranfield, Bedfordshire, MK43 0AL* rrc@therrc.co.uk
[2]*Information Officer – The River Restoration Centre*
[3]*Director – ATPEC River Engineering Consultancy*

Abstract

For centuries, weirs have been constructed across rivers to fulfil a wide variety of aims, including power generation (milling or hydro), navigation, irrigation, angling, flow measurement or amenity. Many weirs no longer fulfil their original function and may be considered for removal in order to restore the river to a more natural state, as each weir will have altered the geomorphology of the river in its vicinity.

However, there is still concern about where and when it is appropriate to remove a weir. For instance, a weir constructed to impound water for a mill may create a wide expanse of water upstream, appreciated by the local population for its aesthetics, its angling and the ducks which inhabit it. Removal of that same weir could create a narrow, fast flowing stream flanked by muddy banks which would quickly become covered heavy marginal vegetation. Whilst this may be an improvement in habitat for some species the general public may consider it to be less attractive. In more dynamic systems, concerns about bank stability upstream are often cited as a reason for not removing a weir.

The River Restoration Centre completed a review of weir removal projects for the Environment Agency, based on data held on the Centre's National River Restoration Inventory and follow-up questionnaires. The aim was to provide information to increase the evidence base of weir removal success and hence reduce the current level of uncertainty associated with removal.

This paper will provide a summary of the information collected and, through a series of case studies, outline what are the key elements that need to be considered when removing a weir.

Keywords: Bank erosion; Bank protection; Literature review; Guidance; Case study evidence

A SIMPLE WAY TO EASE FISH AND EEL PASSAGE ACROSS A SLUICE APRON

M. PORTER[1], A. MARTIN[2] & A. FRASER[3]

[1]*Project Officer – Environment Agency, Rivers House, Sunrise Business Park, Blandford Forum, DT11 8ST*
mike.porter@environment-agency.gov.uk
[2]*Fisheries Technical Specialist – Environment Agency, Blandford Forum*
[3]*PSA Delivery Officer – Environment Agency, Blandford Forum*

Abstract

The Water Level Management Plan (WLMP) programme has delivered over £4 million worth of improvements in the Wessex area. Its main focus, The River Avon System SSSI and SAC is designated for Ranunculus vegetation, Atlantic salmon, sea and brook lamprey, bullhead and Desmoulin's whorl snail, and was largely in unfavourable condition due in part to water level management issues. The WLMP programme has greatly improved conditions for SSSI species by reviewing the apportionment and impoundment of water and taking appropriate action to reach favourable/recovering condition through extensive works on the ground.

One such example, Ashley Stream Hatches, controls flow apportionment between Ashley and King Streams, both part of the SSSI and SAC. The structure is 450m downstream of an open offtake from the main Avon, and comprises three large sluices which were in a poor state of repair, hampering operation and affecting the flow regime and habitat quality in these important fisheries channels. The structure's apron is 5x4 m wide, and under low flow conditions, impeded upstream fish and eel passage owing to the shallow depth of water and the ~0.5m metre difference in levels between the apron and the weir pool. Cost and land management issues discounted total removal, so a range of solutions were considered to make the structure passable, whilst maintaining its operation. Due to the site's location within the Avon Valley and New Forest, the solution had to be in-keeping with its surroundings. The preferred option was to refurbish the existing hatches to a safe operable condition and use natural and site-won materials to ease fish and eel passage.

This was achieved by creating a ponded area on the concrete apron to increase the depth of water flowing over it. A semi-circular adherent nappe on the apron face also helps upstream passage during low flows. It was necessary to raise levels in the downstream weir pool to bring them closer to that of the weir apron, which was done by the installation of three notched log weirs downstream of the pool, using site-won timber and local gravel. These were big enough to be tied into the bank and stream bed to ensure they are sufficiently watertight so as not to create a further barrier to fish.

This solution has a limited lifespan (10-20 yrs), but in the meantime provides a comparatively quick (3 weeks), cheap (£30k) and low-carbon-footprint solution to easing passage, without preventing future installation of a more engineered pass or structure removal at a later date.

Keywords: Low cost; Low carbon; Fish passage; Log weirs; Weir bypass

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SESSION 5

Restoring rivers – The challenges of implementing whole-river plans and implications for the wider river network

JENNY WHEELDON

River restoration Specialist – Natural England/Environment Agency

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SESSION 6:

PARTNERSHIP WORKING & LOCAL ENGAGEMENT

Partnerships for river restoration - More for less?

RUTH NEEDHAM *et al.*
Project Manager – OnTrent

How the Thames won the 2010 International Riverprize

ALASTAIR DRIVER
National Conservation Manager – Environment Agency

Development of a Water Framework Directive-driven restoration strategy for the River Trent

D. FRASER *et al.*
Principal Scientist – APEM

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PARTNERSHIPS FOR RIVER RESTORATION - MORE FOR LESS?

RUTH NEEDHAM[1], JULIE WOZNICZKA[2] & TIM PICKERING[3]

[1] *OnTrent Project Manager – The Wolseley Centre, Wolseley Bridge, Stafford, ST17 0WT*
ontrent@staffs-wildlife.org.uk
[2]*OnTrent Project Manager – The Wolseley Centre, Wolseley Bridge, Stafford, ST17 0WT*
[3]*Technical Specialist, Strategic & Devt. Planning – Environment Agency, Midlands Region, Sapphire, Solihull*

Abstract

The Trent's catchment occupies 8% of England and passes through over 21 local authority areas, yet many feel that it is one of England's major 'forgotten rivers'. The OnTrent Initiative is a partnership with the vision of 'a Trent landscape, rich in wildlife habitats, landscape and historic features for the benefit of all, both now and in the future'. Our core work is about adding value and capacity building – it's about developing projects and policy from ideas to reality. Now well established, OnTrent has been informing strategy and initiating projects in the valley and wider catchment since 2002. There are now landscape-scale projects delivering wetland and river based work throughout the entire Trent corridor, with benefits including a long distance path, mapping; enhancement of the landscape, historic environment, communities and biodiversity; as well as training and seminars.

National policy which has increasingly promoted wider, coordinated management, such as the Catchment Flood Management Plan, River Basin Management Plan and the Flood and Water Management Act 2010, all provide a formal route for new partners, in particular Local Authorities, to become more involved with water management at a catchment or sub-catchment scale. However, increasingly restricted funding is forcing resources to become almost entirely target driven. A lack of core funding limits the ability of partner organisations to be involved with strategic work and makes supporting such an extensive network of projects and partners particularly challenging.

This seminar will discuss such threats, future priorities and opportunities for OnTrent and similar initiatives. It will examine whether partnerships across a river catchment really can deliver more for less. With government agencies more likely to be restricted to core functions in coming years, it is suggested that alliances such as these may have the flexibility to identify gaps and exploit opportunities to work innovatively across sectors.

In particular, OnTrent plans to support Farming and Water for the Future (projects across the catchment to store flood water on farmland); further development of the Trent Valley Way; Blue Infrastructure enhancement (working with local authorities); and large scale restoration plans, particularly as part of aggregate extraction mitigation amongst others. It is recognized that the partnership will need to be adaptable and resilient, able to take on new projects and *deliver*; be more creative than ever about how to access and use funding from a range of sources; and find ways to engage more effectively with both the commercial sector and local authorities.

We consider that OnTrent has many strengths but would greatly benefit from a more coordinated national approach to support it and other catchment based partnership projects.

Keywords: Integrated catchment management; Multiple benefits; Flooding; Green infrastructure; Biodiversity; Access

HOW THE THAMES WON THE 2010 INTERNATIONAL RIVERPRIZE

ALASTAIR DRIVER

National Conservation Manager – Environment Agency, Kings Meadow House, Reading, Berks. RG1 8DQ
alastair.driver@environment-agency.gov.uk

Abstract

The A$350,000 International Thiess Riverprize is the world's largest environmental prize and it celebrates outstanding achievements in river management and restoration. It is awarded each year at the International Riversymposium in Australia and gives an incentive to further worldwide efforts to repair damaged rivers and waterways. It also celebrates world best practice in the stewardship of rivers. The Riverprize is a partnership between the International Riverfoundation and the International Riversymposium.

In 2010, the Environment Agency submitted a successful bid for the River Thames to win the prize, on behalf of thousands of people from hundreds of organisations who have worked tirelessly to restore the river and its catchment over the last 50 years. The Thames was selected out of a record number of entries and in the final it was up against the world-famous and three times finalist, Yellow River (China), Hattah Lakes (Australia), and the Smirnykh Rivers Partnership (Russia).

Pollution of the tidal Thames left it biologically dead in the 1950s, but since then the river has been transformed into a thriving ecosystem teeming with fish, and with returning sea trout and otter populations. However, the prize submission acknowledged that there is still much work to be done to continue improving the quality of the river – especially the tidal Thames and its tributaries in London.

The Environment Agency's submission focused on 5 wide-ranging projects to demonstrate the innovative and challenging solutions now underway to achieve this further improvement:

- Catchment Sensitive Farming: working with farmers to reduce rural diffuse pollution from nutrients and pesticides.
- The Jubilee River flood alleviation scheme: creating a new 11 km stretch of naturalistic river and habitats, whilst delivering flood protection to 5,500 homes.
- The London Rivers Action Plan: helping restore London's urban rivers, with 58 new river restoration projects in progress since its launch in 2009.
- The London Tideway Tunnels: a £3.6bn+ scheme tackling the 39 million tonnes of untreated sewage flushed into the Thames by storms in a typical year.
- Thames Estuary 2100: a 100-year adaptable plan directing the future sustainable management of tidal flood risk in the Thames estuary, and protecting over 1.25million people and £200bn in property value.

Keywords: Restoration; Catchment; Partnership

DEVELOPMENT OF A WATER FRAMEWORK DIRECTIVE-DRIVEN RESTORATION STRATEGY FOR THE RIVER TRENT

D. FRASER[1], M. TURNER[2] & D.R. JOHNSON[3]

[1]*Principal Scientist – APEM Ltd, Centre for Innovation and Enterprise, Oxford University Begbroke Science Park, Sandy Lane, Yarnton OX5 1PF* d.fraser@apemltd.co.uk
[2]*Consultant Scientist – APEM Ltd, Yarnton*
[3]*Fisheries Technical Officer – Environment Agency, Lichfield, Staffordshire*

Abstract

APEM Ltd was commissioned by the Environment Agency to develop a strategic programme of prioritised river restoration measures on the River Trent, from Stoke-on-Trent to the confluence with the River Sow at Great Haywood. The primary objective of the programme is to address factors currently constraining Water Framework Directive (WFD) Good Ecological Status on the two WFD water bodies which comprise this 40 km reach.

Initial appraisal of both hydromorphological and biological elements was undertaken to inform restoration options. Hydromorphological elements were appraised via a comprehensive walkover survey encompassing fisheries habitat survey, mapping of physical modifications and impacts (including barriers to fish migration) and sediment tracing techniques previously developed by APEM to identify diffuse pollution pathways and sources. Ecological elements were obtained from a combination of existing EA records (invertebrates, macrophytes, River Habitat Survey and water quality) and a bespoke comprehensive survey of fish undertaken by APEM. The requirement to identify physical factors likely to constrain angling participation was an additional social and recreational element of the project.

Key constraints will be determined via the assembled hydromorphological and ecological data. This in turn will enable restoration measures designed to alleviate these constraints to be provisionally identified.

The ultimate objective will be production of a prioritised list of restoration actions, which will serve as a medium term programme of work for the Environment Agency and partners. Production of such a list will entail the development of a prioritisation system, which will be based on benefits envisaged, most notably in terms of WFD, but also in terms of other statutory and local drivers (e.g. Eel Management Plans and recreational angling) and benefits and desirability amongst stakeholders versus costs of measures. Given the need for broad stakeholder support to facilitate and deliver the programme, stakeholder consultation on the provisional list of measures is a core element of the project, and will be key in prioritising and finalising the measures.

Keywords: Strategic restoration; Prioritisation; Stakeholder; Fisheries; Walkover

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SESSION 7A:

NOTT FAR FROM NOTTINGHAM

"Trout in the Town" - Urban river restoration and promotion by local community groups

P. N. GASKELL

Programme Manager: "Trout in the Town" – The Wild Trout Trust

Assessing the past for the future: A case study of Nottinghamshire's forgotten water meadows

J. HILLMAN *et al.*

Senior Soil and Water Scientist – URS-Scott Wilson

Restoration of riparian habitats on the old course of the River Ise in Northamptonshire

R.G. FIELD *et al.*

Revital-ISE Project Manager – River Nene Regional Park CiC

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"TROUT IN THE TOWN"
URBAN RIVER RESTORATION AND PROMOTION BY LOCAL COMMUNITY GROUPS

P. N. GASKELL

Programme Manager: "Trout in the Town" – The Wild Trout Trust, PO Box 120, Waterlooville PO8 0WZ
pgaskell@wildtrout.org

Abstract
Trout in the Town is a UK-wide project launched by the Wild Trout Trust in 2008 to engender local community custodianship, education and engagement with restoration of urban rivers. Two branches of this project close to Nottingham are the River Erewash (River Erewash Foundation, Notts.) and the River Don (SPRITE, South Yorks.). The project has also delivered classroom and outdoor educational activities promoting healthy rivers and responsible water-use in the Staffordshire area.

Dramatic improvements to water quality in recent decades mean that pollution-sensitive species of fish, invertebrates and plants are, again, colonising our urban river corridors. However, local human populations often remain wedded to lifelong precepts that their urban watercourses are dirty and lifeless. This situation is often compounded by the prevalence of fly-tipping in urban watercourses that seems to confirm a "polluted" verdict to the casual observer.

Here, I outline relevant case study examples of the challenges and progress of local groups in tackling both the biological and sociological issues encountered by volunteer-group urban river restoration efforts.

Keywords: Biodiversity; Education; Engagement; Custodians

ASSESSING THE PAST FOR THE FUTURE: A CASE STUDY OF NOTTINGHAMSHIRE'S FORGOTTEN WATER MEADOWS

J. HILLMAN[1], S. LAMBERT[2], K. STEARNE[3], B. DUNNING[4] & R. BOWER[5]

[1]*Senior Soil and Water Scientist – URS-Scott Wilson, Nottingham* Jonathan.Hillman@scottwilson.com
[2]*LIS Project Officer – Nottinghamshire County Council, Trent Bridge House, West Bridgford, Nottingham*
[3]*Water Meadow Advisor – Natural England, Victoria House, Cross Lanes, Guildford, Surrey*
[4]*Land Management and Conservation Advisor – Natural England, Ceres House, Lincoln*
[5]*Tenant – Manor Farm, Carburton, Nr. Worksop, Nottinghamshire*

Abstract

A water meadow is a man-made pasture irrigation system, aiming either to increase total grass production or bring it forward in the year, by irrigating 'panes' of grass with shallow flowing water. The water, warmer than the surrounding soil, allows growth during winter months, with the added benefits of nutrients, readily available oxygen and a liming effect.

Water Meadows are part of Nottinghamshire's rural history, dating to the 19th Century; generally forgotten, but within living memory of local communities. Research has re-discovered large areas of meadows in the Maun, Meden and Poulter Valleys, as well as other smaller systems. The Estates of the Dukeries were responsible for considerable water engineering, including the 125 ha Clipstone meadows on the Maun. Despite widespread historical area, water meadows suffered post-war decline, going out of use in the late 1960's. Nottinghamshire's little known 'catchwork' systems, now a generally neglected relic of the landscape, contrast with southern England's well researched, documented and sometimes preserved 'bedwork' systems, where soils, geology and climate are also quite different.

There are many potential benefits from restoration of these low input agricultural systems, including additional areas of priority wet grassland habitat for the county, encouraging wading birds; trapping sediment and adsorbed phosphorus; and education potential. All these benefits can be delivered through Higher Level Scheme (HLS) funding.

This presentation describes work to begin to select a Nottinghamshire water meadow for restoration, which uncovered several previously forgotten sites. Work to characterise the functioning of the system is also discussed, which led to a number of historic features being unearthed following aerial and ground-based survey, plus research into historical documents. During 2010, a pilot area was restored using, as far as possible, historically accurate methods. A management plan was also drafted for the remaining site, primarily aimed at creating wet grassland habitat, but also allowing controlled access to view key features.

A key research finding has been the sheer area of undocumented water meadows in Nottinghamshire and the Midlands. Though many systems are beyond restoration, even sites impacted by subsidence could have a key role to play in delivering environmental objectives.

Keywords: Water meadow; Nottinghamshire; Wet grassland; Water quality; Habitat; Catchwork; Restoration; Agri-environment; Education

RESTORATION OF RIPARIAN HABITATS ON THE OLD COURSE OF THE RIVER ISE IN NORTHAMPTONSHIRE

R.G. FIELD[1], N. MONAGHAN[2] & J. PEARMAN[3]

[1]*Revital-ISE Project Manager – River Nene Regional Park CiC, John Dryden House, 8-10 The Lakes, Northampton, NN4 7DE, 01604-237243 Email: rfield@northamptonshire.gov.uk*
[2]*Project Officer – River Nene Regional Park CiC, John Dryden House, Northampton*
[3]*Reserves Manager – Northamptonshire Wildlife Trust, Lings House, Billings Lings, Northampton, NN3 8BE*

Abstract

Within the last 100 years much of the course of the River Ise in Northamptonshire has been modified. Most of the cornmills and associated water features have disappeared or, as with the water meadows at Wicksteed, have become disconnected from the main river. Several areas where the old meanders remain next to the river were Local Wildlife Sites (LWS), but in some cases as succession took place these areas lost their botanical interest. The Revital-ISE Project, which started in 2008, has been instrumental in the campaign to restore these features and three sites have been specifically targeted. It is hoped that once restored some of these sites will be managed by the local communities and as such a new community group called 'Natural-ISE' has been formed.

The first site was the Wildlife Trust reserve at Tailby Meadows, Desborough, while the second was at the 'Ise Valley Park' in Kettering. Just below those sites in Kettering is the third site which is a remnant of the water meadow system which was found down the Ise valley. This site which is approximately 7ha in size is being restored to its former glory.

In a separate initiative a range of training events have been held at a local field centre for groups of local volunteers. These covered many aspects of managing and surveying the countryside. These volunteers will then hopefully be able to manage their own local sites in the future.

Keywords: Revital-ISE; Meanders; Local volunteer groups; Wet grassland; Tailby Meadows; Community training events; Ise Valley Park

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SESSION 7B:

PARTNERSHIPS GREAT & SMALL

3 Rivers clean up – Ravensbourne catchment SE London
A partnership approach to invasive species removal on a catchment scale

VICTOR RICHARDSON *et al.*
SE London River Programmes Coordinator – Thames21

Partnership works in Northern Ireland - Always start with a cup of tea

J. BANKHEAD & G. GREER
Conservation Officers – Rivers Agency, Belfast

The role of self-help groups in river flood management

J. SIMM
Technical Director – HR Wallingford

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3 RIVERS CLEAN UP – RAVENSBOURNE CATCHMENT SE LONDON

A PARTNERSHIP APPROACH TO INVASIVE SPECIES REMOVAL ON A CATCHMENT SCALE

VICTOR RICHARDSON[1], MATTHEW BLUMNER[2] & CHRIS MCGAW[3]

[1]*SE London River Programmes Coordinator – Thames21, Walbrook Wharf, Upper Thames St, London EC4R 3TD vic.richardson@thames21.org.uk*
[2]*Founder Member – Quaggy Waterways Action Group, c/o 86 Lewisham Hill, London SE13 7EL*
[3]*Rivers & People Officer – Lewisham Council*

Abstract

The eradication of invasive non-native species from riverine habitats is a long labourious task and needs a stratgegic approach to tackle the issue effectively. Different invasive species require different techniques for removal. At the 3 Rivers clean-up, a catchment wide programme of events was coordinated by a range of local partners. The events involve local volunteers manually removing Himalayan Balsam (Impatiens glandulifera) from along the River Ravensbourne, River Pool and the Quaggy River that make up the catchment. The project aims to effectively manage Himalayan Balsam by creating an annual programme of activities attended by volunteers recruited from a wide range of sources including local residents, existing friends groups, community organisations and corporate groups.

The project's greatest resource is the volunteers, but when looking at the Ravensbourne catchment, some areas have very good support and others very little or none. Increasing volunteering capacity over the catchment is important for the project's success as it will be necessary to cover the entire river system and not just the worst affected areas. In this case, increasing capacity on the upper reaches will be crucial to forming a more strategic approach to removing Himalayan Balsam, source to mouth.

An added complication or asset is that the river flows through 3 London boroughs, increasing resources and support available to the project but also complicating decision making. However, the partnership with local authorities, local groups such as Quaggy Waterways Action Group (QWAG), Thames21 and the Environment Agency, has worked well in delivering this project. Perhaps the greatest outcome is the raised awareness that is now shared with the public and the opportunity to learn more about their river systems.

Keywords: Thames21; Himalayan balsam; Volunteers; Catchment management; QWAG; Enhancement

PARTNERSHIP WORKS IN NORTHERN IRELAND - ALWAYS START WITH A CUP OF TEA

J. BANKHEAD & G. GREER

Conservation Officers – Rivers Agency, Hydebank, Hosptial Road, Belfast BT8 8JP
judith.bankhead@dardni.gov.uk

Abstract

Rivers Agency is the flood defence and drainage authority in Northern Ireland, and as such, has a narrow legislative remit. Working under the Drainage Order (NI) 1973, there is no specific permission for restorative or conservation lead works. Consequently most such work is often carried out through partnership projects.

Partnership works tend to be based on biodiversity and enhancement, and aim to have an additional benefit to the Agency through reduced maintenance, bank stability, etc. Rivers Agency provide input through design, advice and provision of plant and labour, but not through direct funding. Projects tend to be small in nature, and directed at the reach scale. Partners include other government bodies, local councils, local interest groups and NGOs.

This seminar will present experiences from Northern Ireland, focusing on two particular examples:

Lower Bann Erosion Project. A joint project with the Lough Neagh and Lower Bann Advisory Committee, with works based upon bioengineering solutions to bank erosion problems. Erosion is due to a range of factors including water sports, arterial drainage legacy, and lack of bankside fencing. Measures used included willow faggots, coir rolls and recycled Christmas trees. Monitoring of the project has been carried out using fixed point photography.

Kilnatierney Managed Retreat and Wetlands Project. Situated within an ASSI and abutting a SPA, this is a joint project with the National Trust. Work has been carried out in two distinct phases - firstly, the creation of freshwater, winter inundation, using sluice-controlled flow from a field edge river, and land sculpting. This was designed to encourage wintering wildfowl, a SPA criterion. Secondly, controlled breaching of a sea defence to allow inundation to a brackish lagoon (which was becoming increasingly fresh in character) and encourage the rise of the Spire Snail!

Keywords: Bann; Erosion; Christmas tree; Faggots; Kilnatierney; Inundation; Sea defence; Lagoon; Brackish; *Hydrobia acuta*

THE ROLE OF SELF-HELP GROUPS IN RIVER FLOOD MANAGEMENT

J. SIMM

Technical Director – HR Wallingford, Howbery Park, Wallingford OX12 9UJ j.simm@hrwallingford.co.uk

Abstract

In flood risk management, stakeholder engagement or "citizen participation" has been endorsed at the European Level and is part of UK national policy. However, the forms of participation now emerging in flood management go well beyond consultation and engagement, to local funding and participation, a trend which was supported by Sir Michael Pitt's report on the Summer 2007 floods and has now been strongly endorsed by the 'big society' theme of the new coalition government.

Alongside these changes, the pressures on limited budgets within organisations like the Environment Agency and prioritisation of maintenance work has meant that the service that smaller (often rural) communities have come to expect is unlikely to continue. Many citizens now feel that reduced levels of maintenance are contributing to an increased risk of flooding and consequently, local flood action self-help groups are starting to form to organise maintenance work or construct flood defences.

Based on data from semi-structured interviews and working experiences, this paper will provide some reflections on groups within the Thames Region and on the South Coast and will compare this with analogous experiences in environmental river management. The discussion will cover the activities (weed cutting, dredging, defence repair/raising, etc.) and motivations (desire to mitigate loss and reduce insurance premiums, active citizenship, physical fitness, etc.) of these groups. The paper will also identify some barriers to voluntary activity, including legal and insurance issues and riparian ownership and will conclude with some reflections on the future for such groups.

Keywords: River management; Flood management; Self-help groups

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POSTER PRESENTATIONS

Contrasting hydromorphological systems: Differences between engineered and near natural reaches of the River Dee at Braemar

C. ANDERTON *et al.*
Senior Analyst – JBA Consulting

Catchment and local scale restoration challenges in a high energy Scottish catchment

C. ANDERTON *et al.*
Senior Analyst – JBA Consulting

A new coarse resolution, rapid-assessment methodology to assess the passability of obstacles to fish migration

C. BULL[1] & C. BROMLEY[2]
[1]Senior Consultant - Centre for River EcoSystem Science, University of Stirling
[2] Senior Hydromorphologist - Ecology Partnership & Development Unit, SEPA

Targeted maintenance, Mill Operating Protocols and river restoration strategy to deliver flood risk management and Good Ecological Potential at least cost

R. A. CHASE[1], & A. C. PAOLI[2]
[1]Principal River Consultant – Atkins
[2]Civil Engineer – Atkins

Delivering a sustainable approach to controlling invasive non-native species on Dumfries and Galloway's Rivers

ANNE CONNICK
Catchment Management Planning Officer – SEPA

Facilitating the application of Output from REsearch and CAse STudies on Ecological Responses to hydro-morphological degradation and rehabilitation (FORECASTER)

I. COWX *et al.*
Professor of Applied Fisheries Science – University of Hull

Implementing a monster river restoration programme

JO CULLIS *et al.*
Principal Environmental Consultant – Halcrow

Building in sustainability – The use of synthetic geo-textiles in river restoration

P. F. EASTON[1] & S. CAIN[2]
[1]*Senior Consultant – Cain Bio-Engineering*
[2]*Managing Director – Cain Bio-Engineering*

Practical River Appraisal Guidance for Monitoring Options (PRAGMO)

J. ENGLAND *et al.*
Environmental Monitoring Team Leader – Environment Agency

Metal concentrations in sediments within restored and un-restored London rivers

H.M. GIBBS *et al.*
PhD Student - School of Geography, Queen Mary, University of London

Utilising river restoration to improve water quality

D. M. HAMMOND[1] & A. SCOTT[2]
[1]*Senior Projects Adviser – The River Restoration Centre*
[2]*Lead Environmental Advisor – Yorkshire Water*

Predicting ecological gains following assisted natural recovery:
An example from the River Ribble at Long Preston Deeps

G. L. HERITAGE[1] & K. SHEEHAN[2]
[1]*Technical Director – JBA Consulting*
[2]*Senior Analyst – JBA Consulting*

The hydromorphological consequences of channel management:
Lessons from upland systems in the UK

G. L. HERITAGE *et al.*
Technical Director – JBA Consulting

An ecological vision for the River Lugg SSSI

B. LASCELLES *et al.*
Technical Director – Hyder Consulting

Local partnership and mechanical excavators deliver value for money and sustainable river restoration

A. MAXWELL *et al.*
Water Level Management Plan Project Officer – Environment Agency, South West Region

Developing cost-effective restoration options for the Nant Mills fish pass

J. A. MOON[1], & R. JONES[2]
[1]*Senior Geomorphologist – Black & Veatch*
[2]*Principal Engineer – Black & Veatch*

Morphological adjustment and ecological response to tributary reconnection in an upland river

E. C. QUINLAN *et al.*
PhD student – Northern Rivers Institute, University of Aberdeen

Some simple tools for communicating the biophysical condition of urban rivers to support high-level discussions regarding river restoration

LUCY SHUKER
PhD researcher – Queen Mary, University of London

NOTES…

CONTRASTING HYDROMORPHOLOGICAL SYSTEMS: DIFFERENCES BETWEEN ENGINEERED AND NEAR NATURAL REACHES OF THE RIVER DEE AT BRAEMAR

C. ANDERTON[1], G. L. HERITAGE[2], D. MILAN[3] & S. COOKSLEY[4]

[1]*Senior Analyst – JBA Consulting, Port Neuk, Longcraig Road, South Queensferry, Edinburgh EH30 9TD*
Caroline.Anderton@JBAConsulting.co.uk
[2]*Technical Director – JBA Consulting, The Brew House, Wilderspool Park, Warrington WA4 6HL*
[3]*Senior Lecturer – Department of Natural & Social Sciences, University of Gloucester, Cheltenham GL50 4AZ*
[4]*Project Officer – Dee Catchment Partnership, The Macaulay Institute, Aberdeen AB10 1YP*

Abstract

The hydromorphic variation of the majority of UK rivers has been altered as a result of flow modification, engineering works and land management. This paper looks at the effects through the survey and mapping of two reaches of the River Dee upstream of Braemar in Scotland.

Aerial LiDAR and Acoustic Doppler Velocity Profiling provided the baseline morphologic and hydraulic validation data for a 2D flow model of a single thread reach subject to channel training and an unconstrained wandering section flowing across a more natural floodplain further upstream. The model was used to simulate a series of flows from 4 (baseline survey) up to 100 m^3s^{-1} (approximately bankfull discharge) and depth and velocity data were extracted to generate the Froude number for each wetted cell in the 2m grid cell model arrangement. These data were then categorised according to biotope unit based on published Froude number limits allowing biotope variety, variability and dominance to be calculated and compared between sites for each flow.

It is clear from the results that the engineered section is generally biotope poor with low variety and variation even at low flows. This contrasts markedly with the pattern and types of unit modelled for the more natural reach. In contrast to previous research on more uniform rivers there was also an increase in biotope variety as flows increased due to the activation of chute channels and the inundation of bar surfaces to generate new hydraulic units within the wandering channel boundary. It is clear that engineering has had a major affect on the hydromorphology of the River Dee at both low and high flows and that this in turn has impacted adversely on in-stream habitats and biology.

Keywords: Hydromorphology; Geomorphology; LiDAR; ADVP; Biotopes

CATCHMENT AND LOCAL SCALE RESTORATION CHALLENGES IN A HIGH ENERGY SCOTTISH CATCHMENT

C. ANDERTON[1], G. L. HERITAGE[2] & J. WRIGHT[3]

[1]*Senior Analyst – JBA Consulting, Port Neuk, Longcraig Road, South Queensferry, Edinburgh EH30 9TD*
Caroline.Anderton@JBAConsulting.co.uk
[2]*Technical Director – JBA Consulting, The Brew House, Wilderspool Park, Warrington WA4 6HL*
[3]*Clerk – Argyll District Salmon Fishery Board, Cherry Park, Invarrary, Argyll & Bute PA32 8XE*

Abstract

The Carradale Water drains a 59 km^2 catchment on the eastern side of the Kintyre Peninsula, Argyll, Scotland. It initially flows through steep confined valleys cut into resistant Schist geology, before exiting onto a wide floodplain composed of fluvio-glacial alluvium and discharging into the Kilbrannan Sound. Under the Water Framework Directive, the Carradale Water is currently classified as having a moderate status, where historical drainage and agricultural improvement activity, together with more recent local flow diversion and catchment intensive forestation has impacted on the flow and sediment balance within the watershed. The river is a high energy system and is presently responding to these changes through intense local morphological adjustment. Concern exists over the currently unstable state of the watercourse, with large scale sediment deposition and associated erosion and channel migration affecting valuable farm land and habitats in the lower reaches. Due to the number of stakeholders within the catchment a local working group has been formed to address these issues and inform future catchment planning and restoration.

This paper discusses the first stage of a project designed to develop a sustainable river management plan through a catchment management scoping study identifying the challenges, constraints and benefits involved in the sustainable restoration of the river and its floodplain. The study has been developed through a catchment-wide geomorphic audit and quantitative modelling of zones of high mobility using a 2D mobile bed approach which combines hydraulic and ecological predictions using the River2D flow model. Optioneering using the model simulations has facilitated the development of a long term high level catchment restoration plan linked to short and medium term local scale mitigation options to alleviate bank erosion along presently unstable reaches. Reducing the magnitude and frequency of spate flows, encouraging natural bar development processes and promoting chute channel cutoff processes appears to be key to securing long term stability along the river, facilitating riparian vegetative sediment stabilisation and allowing flood flows to be redistributed along wooded secondary channels.

Keywords: River restoration; Geomorphology; Floodplain; 2D modelling

A NEW COARSE RESOLUTION, RAPID-ASSESSMENT METHODOLOGY TO ASSESS THE PASSABILITY OF OBSTACLES TO FISH MIGRATION

C. BULL[1] & C. BROMLEY[2]

[1]*Senior Consultant - Centre for River EcoSystem Science, University of Stirling*
[2] *Senior Hydromorphologist - Ecology Partnership & Development Unit, Scottish Environment Protection Agency, Chris.Bromley@sepa.org.uk*

Abstract

A new method has been developed that provides a means of rapidly estimating the likelihood that migratory fish of several different species will be able to pass, both upstream and downstream, the full range of obstacles found on British rivers. Such a method is required to improve and to extend the coverage of river fish classification for the Water Framework Directive; to identify critical, man-made bottleneck obstacles in a catchment that can be targeted for removal or the installation of fish passage facilities; and to help improve the regulation of abstractions and impoundments. Existing fish data are generally not at the spatial or temporal resolution needed to assign an estimate of passability to each obstacle and the collection of such data is time consuming. Expert judgment assessments are thus generally used to assign a degree of passability to obstacles. The reasons underlying an expert judgment are frequently not recorded, or are not recorded in a consistent fashion, however, so it can be very difficult to understand how an assessment of passability was arrived at. Using the new method, all the data used to assign a passability score are clearly recorded and easily auditable.

The method is based on the collection of flow depth and velocity measurements at different points along an obstacle and some simple measurements to describe obstacle geometry. Additional features of relevance to fish passage, such as a pool out of which a fish can leap, or the presence of climbing substrate for eels, are also recorded. Flow depths and velocities are then compared to published values on the swimming abilities of different fish species in order to assign a passability score for each measurement point. Passability scores are also assigned for the presence or absence of additional features. All passability scores are then combined to come up with one overall estimate of passability for each species in both the upstream and downstream directions.

Keywords: Water Framework Directive; Swimming performance; Flow depth; Flow velocity

TARGETED MAINTENANCE, MILL OPERATING PROTOCOLS AND RIVER RESTORATION STRATEGY TO DELIVER FLOOD RISK MANAGEMENT AND GOOD ECOLOGICAL POTENTIAL AT LEAST COST

R. A. CHASE[1], & A. C. PAOLI[2]

[1]*Principal River Consultant – Atkins, Epsom, Surrey KT18 5BW* robin.chase@atkinsglobal.com
[2]*Civil Engineer – Atkins, Epsom, Surrey KT18 5BW*

Abstract

The River Wensum is a chalk river and one of 31 whole river SSSIs in England and Wales, and is currently in unfavourable condition. It is also one of 16 English rivers designated as a Special Area of Conservation (SAC). Atkins has been commissioned by the Environment Agency (EA) to produce 9 Feasibility and Environmental Scoping Reports to implement the River Wensum Restoration Strategy over its entire 71 km length. 14 mills, owned privately or by the EA, impound up to two-thirds of the Wensum's length. An extensive network of Internal Drainage Board (IDB) drains discharge into the river, and the EA receives a precept for maintenance. 4 villages are also at risk of flooding within the main river floodplain.

The Feasibility Reports provide outline restoration designs to address two of the primary reasons for unfavourable conditions: siltation and physical modification. They also identify options for better river management which sustains natural and improved ecological status recovery through Targeted Maintenance Protocols (TaMPs). Historic physical modification is addressed through the parallel development of Mill Operating Protocols (MOPs).

TaMPs aim to focus maintenance on the areas of direct need and avoid those where there are no assets or flood risk, allowing the river to recover using natural processes. This approach allows effective and efficient use of resources and ensures environmentally sensitive areas are fully considered. Targeted areas include IDB channel confluences, bridges, built-up areas and control structures. MOPs address the impoundments on the river whilst recognising their benefits in terms of limiting the progression of silt downstream – these historic modifications are therefore being used to allow recovery by natural processes. For the first time, through agreement with all stakeholders, MOPs will allow consistent management for all drought and flood flows whilst meeting requirements of the EA and private operators and owners.

The MOP and TaMP provide consistent action by each EA function and external stakeholders and underpin the river restoration proposals for each SSSI unit. They focus the EA's limited resources to ensure the most effective actions are taken to improve the condition assessment of the SSSI, the SAC and Good Ecological Potential. The TaMP also directly satisfies EA action in the Anglian River Basin Management Plan regarding the development of best practice documents for river maintenance works to meet best or optimum ecological quality.

Keywords: Favourable condition; Siltation; Physical modification; Natural processes; Good ecological quality; Best practice

DELIVERING A SUSTAINABLE APPROACH TO CONTROLLING INVASIVE NON-NATIVE SPECIES ON DUMFRIES AND GALLOWAY'S RIVERS

ANNE CONNICK

Catchment Management Planning Officer – SEPA, Newton Stewart anne.connick@sepa.org.uk

Abstract

Invasive non-native species (INNS) are considered to be the 'greatest threat to biodiversity, after habitat loss and destruction'. (*Convention on Biological Diversity').

The Dumfries and Galloway (D&G) INNS Project was started in 2007, on the rivers Nith and Annan, in response to stakeholder concerns over the existing and emerging threats to our rivers from INNS. It has come about through SEPA's D&G Catchment Management Initiative (CMI) and Catchment Management Plans for the Nith, Annan and Dee-Ken, which have highlighted INNS as a significant 'catchment management issue', as well as being listed in the Solway-Tweed River Basin Management Plan (RBMP) as a 'significant water management issue', with many waterbodies listed as adversely affected.

The project is co-ordinated by SEPA's CMI project officer, who is working with key river stakeholders and landowners across the region, with practical work being managed by the District Salmon Fishery Boards (DSFBs). The project dovetails with INNS project work being undertaken across Galloway rivers by Galloway Fisheries Trust, and aims to provide regional contact and support for education and practical control purposes for the INNS issue. Key established species such as Japanese Knotweed and American Signal Crayfish have been targeted so far, but the general INNS issue is also highlighted. The D&G projects are working together to identify a long-term catchment scale, strategic approach to manage existing and emerging INNS, meeting objectives of both the Solway-Tweed RBMP and the INNS Framework Strategy for Great Britain.

Mapping has been undertaken since 2007, across the Nith and Annan catchments (and in Galloway) to identify existing INNS, and two project officers were employed this year through the DSFBs to start practical control work for some of the key species identified. A website has been created (www.dgerc.org.uk/?q=inns), alongside an information leaflet on key invasive river plants, which includes a reporting slip for the public to send sightings to a central database. The project also aims to raise awareness with land managers away from the riverside to encourage a universal preventative approach to INNS across the region. For the duration of the project, staff will be working to reduce the extent of existing INNS to a level where river managers are able to continue work in the future, and are experienced and suitably trained to keep on top of the problem after funding has ended.

Keywords: Nith DSFB; Annan DSFB; SEPA Catchment Management Initiative; Solway Heritage

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FACILITATING THE APPLICATION OF OUTPUT FROM REsearch AND CAse STudies on ECOLOGICAL RESPONSES TO HYDRO-MORPHOLOGICAL DEGRADATION AND REHABILITATION (FORECASTER)

I. COWX[1], T. BUIJSE[2] & N. ANGELOPOULOS[3]

[1]*Professor of Applied Fisheries Science – University of Hull, East Yorkshire HU6 7RX*
I.G.Cowx@hull.ac.uk
[2]*Senior Researcher/Advisor (Ecology) – Deltares, Utrecht, Netherlands*
[3]*Research Assistant – Hull International Fisheries Institute, University of Hull, East Yorkshire*

Abstract

FORECASTER is a European project that has been selected for funding from the 1st call of the IWRM-NET. It is funded by various national organisations across Europe. The project aims at linking river restoration science with practice to support the implementation of robust, cost-efficient rehabilitation strategies for improving rivers and floodplains. The main objective of the project is to assess research outputs and case studies concerning the ecological effects of hydro-morphological degradation and positioning hydromorphology in river rehabilitation strategies. The focus is on the effectiveness to enhance hydrology, morphology and aquatic ecology (fish, aquatic flora, benthic invertebrates).

To give end-user access to the information, FORECASTER has developed a web-based geowiki tool (http://forecaster.deltares.nl). This tool is a knowledge and information system relating hydromorphology and ecology of European rivers. The system presents a compilation of case studies describing the output from river restoration projects as well as knowledge on the impact of pressures and the effectiveness of restoration and mitigation measures. It is intended to help practitioners by presenting experiences about success or failure of the application of different measures. The tool is based on a combination of Google Maps and the WIKIPEDIA approach. Thus users can consult the tool either geographically or by theme. Moreover they can become a contributor. As a contributor, people can enter new case studies on river restoration or improve existing information in the webtool.

Keywords: Geowiki webtool; Hydromorphology; Rehabilitation strategies; River-floodplain ecosystem; River restoration

IMPLEMENTING A MONSTER RIVER RESTORATION PROGRAMME

JO CULLIS[1], BEN BAILEY[2] & DIANNE MATTHEWS[3]

[1]*Principal Environmental Consultant – Halcrow Group Ltd., Burderop Park, Swindon, Wiltshire, SN4 0QD*
cullisj@halcrow.com
[2]*Water Level Management Plan Officer – Environment Agency, Blandford Forum, Dorset, DT11 8ST*
[3]*Lead River Avon Advisor – Natural England, South Wiltshire, South West Region*

Abstract

A strategic restoration plan for the River Avon (November 2009) assessed the physical functioning of the river, and how it impacts on river ecology. The Plan sets out actions to restore the river to a better condition for characteristic fauna and flora. The key goal is to move towards a more naturally functioning and un-constrained system that can adjust and respond to changes without constant management.

Implementing the whole of the Plan would mean a programme of river restoration for 203 reaches representing a total length of 213 km. The total estimated cost for this work is just under £31m. This is clearly a massive programme of works, especially given the current and likely future economic climate. To ensure that a realistic programme could be progressed, we needed to find a way of turning this monster into something more manageable. To this end, we developed an approach to prioritising the reaches and verifying the options, to produce a primary costed programme, whilst achieving as much ecological benefit as possible.

The result of this work is a prioritised programme of river restoration for 55 reaches with a total length of 60km, as agreed with Natural England. These reaches represent the top 28% of the prioritised reaches where implementing river restoration projects will have the greatest impact, in terms of ecological connectivity, addressing key impounding structures and assisting natural recovery. This programme also primarily addresses works of an engineering scale and complexity that would be unfeasible to be undertaken by volunteers or local groups. It is expected that progressing these prioritised sites will provide the catalyst for river restoration works on the other lower priority reaches. One of the first steps will involve verifying the options of the lower-priority reaches, so that all work that can be done by others (such as fishing clubs, local community groups etc.) is co-ordinated and undertaken in a logical manner.

The delivery of strategic river restoration on the River Avon (the 203 river reaches identified by the Plan) will not be achievable without a comprehensive and effective partnership programme including the key stakeholders and led by the Environment Agency over a long time frame. The project aims to successfully meet government targets under PSA3 and the Water Framework Directive, and to maximise opportunities to contribute to Outcome Measure 4, and potentially the creation of BAP habitat for OM5. To achieve this, the delivery of the initial programme (the 55 highest priority reaches) by the Environment Agency working in partnership with others is vital.

This paper summarises the essential steps we have taken in turning this river restoration monster into something more manageable and realistic.

Keywords: River Avon; Strategic; Prioritisation; Partnership; Restoration Plan

BUILDING IN SUSTAINABILITY – THE USE OF SYNTHETIC GEO-TEXTILES IN RIVER RESTORATION

P. F. EASTON[1] & S. CAIN[2]

[1]*Senior Consultant – Cain Bio-Engineering Ltd, Lower Woodford, Salisbury, Wiltshire, SP4 6NQ*
peter.easton@cainbioengineering.co.uk
[2]*Managing Director – Cain Bio-Engineering Ltd*

Abstract

The Challenge:
The task of restoring dredged river channels presents numerous challenges. Typically the river bed, banks and plan form will have been substantially compromised with an outcome characterised by over-wide, steep sided channels, sub-optimal laminar flows and a uniform substrate.

The Solution:
Restoration plans generally involve restoring sinuosity, a more appropriate and varied channel width, diverse flow patterns and a variety of river bed profiles with transitional emergent marginal habitats.

In most cases dredged arisings will have been deposited on the immediate bank edge to form a graded flood bank that isolates the river from its flood plain. These dredgings provide an ideal and easily accessible material for use in river bank construction. However forming them into robust erosion-proof structures presents challenges.

Over the past 5 years Cain Bio-engineering has successfully field-trialed techniques that combine natural and synthetic materials to form durable low-level flood berms. These structures maximise the use of reclaimed dredged materials and natural gravels thereby minimizing the need for imported materials.

Using these techniques we have been able to install erosion-resistant structures that provide a durable framework into which traditional soft engineering techniques such as LWD & CWD can be integrated. The finished structures provide a natural looking and complimentary environmental outcome and have been successfully used in SSSI's and SAC's to create a diverse range of riverine and marginal habitats.

Keywords: Bio-Engineering; Soft engineering techniques; Durability

PRACTICAL RIVER APPRAISAL GUIDANCE FOR MONITORING OPTIONS (PRAGMO)

J. ENGLAND[1], D. HAMMOND[2], J. MANT[3], J. HOLLOWAY[4] N. ELBOURNE[5] & M. JANES[6]

[1]*Environmental Monitoring Team Leader – Environment Agency, 2 Bishop Square Business Park, St.Albans Road West, Hatfield, HERTS AL10 9EX judy.england@environment-agency.gov.uk*
[2]*Senior Projects Adviser – The River Restoration Centre, Cranfield, Bedfordshire*
[3]*Science and Technical Manager – The River Restoration Centre*
[4]*Projects Adviser – The River Restoration Centre*
[5]*Information Officer – The River Restoration Centre*
[6]*Director – The River Restoration Centre*

Abstract

With any river restoration and associated floodplain work there is a need to measure the success or failure of the scheme to demonstrate its environmental benefit. In order to quantify the degree of project success or failure some form of monitoring needs to be carried out. Collated data can then help to increase the knowledge base and identify which techniques, or suite of techniques, are most successful for a range of river types and project objectives. As a result, both future project uncertainty and risk of failure can be reduced.

However, project monitoring is often omitted due to perceived financial constraints and a lack of guidance. The process of designing a "fit for purpose" monitoring or project appraisal method that can answer project objectives or questions is therefore often not given due attention. Even when quantitative (e.g. fish counts) and/or qualitative data (e.g. repeat photography) has been collected, demonstrating that the original objective has successfully been achieved (e.g. improve salmonid fry habitat or increase hydro-morphological diversity) is often difficult.

To help address some of these issues the River Restoration Centre has worked with other organisations and specialists to collate and develop a set of pragmatic guidelines to help the end user determine the most appropriate level of project monitoring for a given set of measurable objectives based on the size, complexity and risk of the restoration project.

Thus the proposed monitoring protocol for large, complex catchment-scale projects may differ from the small reach-scale schemes which are using already tried and proven restoration techniques. It is anticipated that the document will be widely available during 2011 in a web based format.

If you want to learn more about monitoring and river restoration schemes you may want to consider the training workshops provided by the River Restoration Centre – please see the website for details: www.therrc.co.uk

Keywords: River Restoration; Prioritisation; Assessment; Survey

METAL CONCENTRATIONS IN SEDIMENTS WITHIN RESTORED AND UN-RESTORED LONDON RIVERS

H.M. GIBBS[1], A.M. GURNELL[2], C.M. HEPPELL[3] & K.L. SPENCER[3]

[1]*PhD Student - School of Geography, Queen Mary, University of London, Mile End Road, London E1 4NS h.gibbs@qmul.ac.uk*
[2]*Professor of Physical Geography - School of Geography, Queen Mary, University of London*
[3]*Senior Lecturer - School of Geography, Queen Mary, University of London*

Abstract

Sediments within rivers act as a store for various contaminants including metals. The extent to which these sediments store metals, and therefore their quality, is dependent upon a number of physiochemical sediment characteristics including grain size, redox potential and organic matter content. As urban rivers are increasingly being restored through techniques such as bed and bank protection removal, re-meandering and in-channel enhancement, the hydraulic and physical conditions within the river channels are being altered. However, significant consideration has not yet been given to understanding how these restoration practices impact upon contaminant storage and hence ecosystem health in urban rivers.

This poster reports on an investigation of sediment quality, in terms of metal concentrations, in different bed sediment types within restored and un-restored river reaches in London. Four sites with adjacent restored and un-restored reaches were sampled at three times of the year, May, August and November, to coincide with the beginning, middle and end of the in-channel vegetation growing season. Surface sediment was sampled from unvegetated patches of different bed sediment calibre (gravel, sand, silt & clay) and also from sediment surrounding in-channel vegetation stands. The sediment was analysed for a range of metals (Ag, Al, Cd, Cr, Cu, Fe, Mn, Ni, Pb and Zn) and sediment characteristics, including organic matter content and grain size. The poster presents and discusses the spatial and temporal variations in metal concentrations found in these sediments, noting contrasts: between the four sites; between restored and un-restored river reaches; and, between different patch types, particularly emphasising the impact of in-channel vegetation on metal retention. Published sediment quality guidelines are used to evaluate the significance of the observations for river ecosystem health and also for the design, management and use of restored urban rivers.

Keywords: Sediment quality; River restoration; Riverine sediment; Heavy metals; In-channel vegetation.

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UTILISING RIVER RESTORATION TO IMPROVE WATER QUALITY

D. M. HAMMOND[1] & A. SCOTT[2]

[1]*Senior Projects Adviser – The River Restoration Centre, Cranfield Campus, Cranfield, Bedfordshire, MK43 0AL rrc@therrc.co.uk*
[2]*Lead Environmental Advisor – Yorkshire Water, Bradford BD6 2SZ*

Abstract

The River Restoration Centre (RRC) carried out a scoping study on behalf of Yorkshire Water to investigate the potential for using river restoration techniques to improve the water quality of receiving waters in eight small sewage treatment work sites and one combined sewer outfall (CSO) site. All the receiving watercourses have had a history of anthropogenic management/alteration and all but three were in the coal mining region of Yorkshire with its associated landscape disturbance and pollution.

The type of management that the receiving waters had experienced included dredging, channel widening, mine drainage discharge, impoundment by weirs, discharge of motorway drainage, channel re-alignment, channel straightening, bank mowing, flow bifurcation and hard engineered revetments.

The outcome of the scoping study was to identify one or two potential cases which could be taken through to a pilot study phase whereby river restoration will be carried out to determine whether there is an improvement in water quality once the restoration has been carried out. At least one watercourse, Cudworth Dike, has been identified as a potential for a pilot study. This poster briefly introduces Cudworth Dike and explains the potential options for river restoration including channel narrowing, recreation of flow sinuosity using deflectors and thinning of riparian trees along with the introduction of more appropriate bank management techniques.

Keywords: Deflectors; Channel narrowing; Appropriate bank management

PREDICTING ECOLOGICAL GAINS FOLLOWING ASSISTED NATURAL RECOVERY: AN EXAMPLE FROM THE RIVER RIBBLE AT LONG PRESTON DEEPS

G. L. HERITAGE[1] & K. SHEEHAN[2]

[1]*Technical Director – JBA Consulting, The Brew House, Wilderspool Park, Greenall's Avenue, Warrington WA4 6HL George.Heritage@JBAConsulting.co.uk*

[2]*Senior Analyst – JBA Consulting, Denison House, Hexthorpe Road, Doncaster, South Yorkshire DN4 0BF*

Abstract

Given the objective of the Water Framework Directive to improve the ecological integrity of Europe's water bodies, there is a clear requirement to understand the linkages between the geomorphology, hydrology and ecology and thereby establish a sustainable, process driven, basis for river and floodplain restoration in the UK. An understanding of these linkages will allow natural features to be restored through the re-establishment of natural morphological processes and dynamics.

The river restoration plan for the River Ribble at Long Preston Deeps, North Yorkshire (a SSSI), was developed through identifying the key geomorphological and ecological associations, establishing the present day baseline state of the system through expert survey and defining key restoration zones through simple 2D surface water flow modelling. The results of this exercise permitted the prediction of the development of likely future habitats, following the implementation of restoration measures designed to re-establish river-floodplain process connectivity.

It was clear from the combined geomorphology-ecology survey that physical disruption to the floodplain flow inundation regime, combined with inappropriate river and floodplain management, were the primary drivers behind the degraded physical and ecological condition of the SSSI. The associations between key species and river morphology were determined from less impacted sites across the SSSI. This, combined with previously published hydrological requirements for wetland communities, allowed for optimal flood regime conditions, restoring floodplain processes to be established across the SSSI. This permitted the effects of targeted palaeo-feature restoration to be modelled and facilitated the selection of key locations thereby achieving optimum ecological improvements with minimal direct intervention. The approach chosen will minimise disruption to the site and reduce costs, whilst reinstating natural geomorphological, hydrological and ecological links and ensuring the long term sustainability of each planned intervention.

Keywords: Hydromorphology; Geomorphology; Floodplain; SSSI; River Restoration

THE HYDROMORPHOLOGICAL CONSEQUENCES OF CHANNEL MANAGEMENT: LESSONS FROM UPLAND SYSTEMS IN THE UK

G. L. HERITAGE[1], N. S. ENTWISTLE[2] & D. MILAN[3]

[1]*Technical Director – JBA Consulting, The Brew House, Wilderspool Park, Warrington WA4 6HL*
George.Heritage@JBAConsulting.co.uk
[2]*Lecturer – Built and Human Environment Research Institute, Salford University, Manchester M5 4WT*
[3]*Senior Lecturer – Department of Natural & Social Sciences, University of Gloucester, Cheltenham GL50 4AZ*

Abstract

The hydromorphic variation of the majority of UK rivers has been altered as a result of flow modification, engineering works and land management. This paper reviews the present state of upland floodplain dominated river systems in the UK, mapping hydromorphologic complexity and comparing patterns across sites.

As would be anticipated the poorest general hydromorphology (as defined by the spatial and temporal diversity and variability of hydromorphic units) is associated with heavily modified systems, particularly where the channel-floodplain connectivity is degraded from natural. It would appear that the most natural of UK upland floodplain rivers exist as alluvial anastomosing systems, developing an intricate and closely linked network of sub-dominant channels associated with a primary active channel. Sub-dominant channel activation is frequently helping to generate flow and morphological diversity and stabilising the channel network within the bounds of the anastomosing channel system.

In contrast, rivers where the floodplain has been significantly modified through vegetative clearance and sub-channel infilling display a wandering character with poorer hydraulic variability, extensive areas of relatively uniform and unstable gravels, severe local bank instability and reduced temporal hydromorphic variability. This hydromorphic degradation is observable on upland rivers where the flow regime has not been significantly altered suggesting that land management is the primary cause behind the loss of hydraulic variability and increased channel instability.

Based on these findings it is suggested that hydromorphic restoration of such systems is primarily reliant on altering floodplain farming practices to allow anastomosing channels through wet woodland to redevelop.

Keywords: Hydromorphology; Geomorphology; Floodplain; Anastomosed; Upland rivers

AN ECOLOGICAL VISION FOR THE RIVER LUGG SSSI

B. LASCELLES[1], MARK LANG[2] & KATHERINE BRADSHAW[3]

[1]*Technical Director – Hyder Consulting, The Mill, Brimscombe Port, Stroud, Goucestershire, GL5 3QG*
bruce.lascelles@hyderconsulting.com
[2]*Principal Ecologist – Hyder Consulting, The Mill, Brimscombe Port, Stroud, Goucestershire, GL5 3QG*
[3]*Technical Director – Hyder Consulting, 9/10 St Andrew Square, Edinburgh, EH2 2AF*

Abstract

The River Lugg, designated as a SSSI for its entire length and as an SAC in the lower reaches, is considered to be one of the finest examples of both a clay river and a river displaying a transition from nutrient-poor to naturally nutrient-rich water chemistry. However, the channel has, in places, been physically modified (as a result of the presence of bridges and weirs, the development of flood defences and channel straightening or canalisation), and it is generally considered that these modifications are having an impact on the riverine ecology, limiting the potential of this system.

A separate vision was produced for each of the River Types that the SSSI supported, pulling together geomorphological assessment and analysis and ecological interpretation at a whole river scale. The vision characterised the generic impacts of physical modifications and the consequent benefits of restoration, and provides a broad vision for what restoration would seek to achieve in terms of geomorphological form and function, habitat provision and visual character. The River Lugg provides many examples of its natural form, providing habitat suitable for its characteristic ecology and these sections were used to show what the benefits of restoration on the whole river could be.

Photographic representation of the issues resulting from physical modifications, as well as what the naturally functioning system should look like, were used extensively through the vision. Gaps in existing data were highlighted and the key next steps to taking the vision forward set out. It is intended that this ecological vision will provide a foundation for subsequent detailed river geomorphological evaluation/interpretation and whole-river restoration planning.

Keywords: River restoration; Biodiversity; Weir removal; Geomorphology; Physical modifications

LOCAL PARTNERSHIP AND MECHANICAL EXCAVATORS DELIVER VALUE FOR MONEY AND SUSTAINABLE RIVER RESTORATION

A. MAXWELL[1], R SLOCOCK[2] & A FRAKE[3]

[1]*Water Level Management Plan Project Officer – Environment Agency, Rivers House, Sunrise Business Park, Blandford, Dorset DT11 8ST* Alasdair.maxwell@environment-agency.gov.uk
[2]*President – Frome, Piddle and West Dorset Fishery Association, Lawrences Farm, Southover, Tolpuddle*
[3]*Independent River Consultant – Timbergreen House, Sturminster Marshall, Wimborne*

Abstract

Through the River Frome Water Level Management and Rehabilitation Plans, the Frome SSSI is benefitting from a new approach to river restoration, through both partnership projects and cost-effective and sustainable approaches to design and construction. Promoted locally as best practice, so far, projects have been carried out at Woodsford and Moreton.

Moreton Channel was chosen partly due to the poor physical condition of the river but also due to the willingness of the Frome, Piddle and West Dorset Fishery Association and the fishing syndicate to work together with the Environment Agency (EA). This partnership project was match funded between the EA and the Association. The scheme was designed by EA staff and delivered through the Association. A long reach machine was used to diversify the existing gravels of the channel bed profile. Large woody debris was introduced to the channel through the hinging of riparian willow and alders. The hinging technique allows the limbs to stay alive and so further growth within the channel is possible.

The partnership approach enabled good value for money, garnered a strong sense of ownership by the Association and will be adopted on future projects through the catchment.

Woodsford Channel was a reach chosen as one of the most degraded on the River Frome SSSI. Historically it had been dredged, removing significant amounts of the natural bed material to reduce flood risk and improve drainage for intensive farming needs. There was a lack of in-channel and bank profile diversity with little habitat to support the SSSI features.

The EA's internal workforce delivered this project using a similar approach to Moreton. Existing gravels were moved within the channel creating deep pools, riffles and exposed berms, diversifying available habitats and flow patterns. Banks were also reprofiled, increasing the marginal zone and large woody debris was introduced.

The Woodsford project showed what could be achieved with one man and a machine, compared to more traditional, labour-intensive projects. Zero waste was created and, apart from the trees, no material was brought onto site. The project was also designed to be long-lasting and self-sustaining. Both projects are considered highly successful by local river users and will be used as a template for delivery within the River Frome Rehabilitation Plan.

Keywords: Large woody debris; Gravel; In-channel morphology; Bank reprofiling; Flow diversity

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DEVELOPING COST-EFFECTIVE RESTORATION OPTIONS FOR THE NANT MILLS FISH PASS

J. A. MOON[1], & R. JONES[2]

[1]*Senior Geomorphologist – Black & Veatch, Treenwood House, Rowden Lane, Bradford-on-Avon, Wiltshire, BA15 2AU moonj@bv.com*
[2]*Principal Engineer – Black & Veatch, Bradford-on-Avon, Wiltshire*

Abstract

The Afon Gwyrfai rises near Rhyd Ddu in the north-west of Snowdonia National Park and passes through a large lake, Llyn Cwellyn, on its way to the sea near Caernarfon. Dŵr Cymru Welsh Water (DCWW) is currently licensed to abstract water at Llyn Cwellyn and Nant Mills. The Gwyrfai is designated as a Special Area of Conservation (SAC) and one of the qualifying features of this SAC is the presence of Atlantic salmon. An assessment undertaken in 2009 concluded that historic structural modifications to the Nant Mills weir/fish pass had rendered it impassable to fish during low flow conditions.

Following a Review of Consents, the Environment Agency recommended the removal of the weir/fish pass because (1) it was considered the least cost solution in terms of capital outlay and maintenance; (2) the abstraction was no longer utilised; and (3) removal would have a positive effect on restoring the watercourse to its natural condition, helping to achieve Good Ecological Potential status under the Water Framework Directive. Black & Veatch Ltd (B&V) was retained by DCWW to investigate feasibility of removal of the weir/fish pass and develop an outline design for a scheme to facilitate the migration of Atlantic salmon.

A geomorphological and hydraulic assessment was undertaken to consider the impacts of scour erosion caused by the removal of the weir/fish pass. The key objectives were to review the implications of removal on geomorphology and habitats within the SAC and in particular to identify any erosion/depositional issues resulting from works within the channel, and also to minimise the amount of future maintenance required. Erosion potential was determined by utilising the stream power screening tool, along with developing an understanding of the baseline geomorphology and historic channel dynamics.

The assessment identified that the unmitigated removal of the weir/fish pass was unlikely to be an acceptable solution due to reduced water levels upstream and the potential for substantial vertical incision of the channel bed. These combined effects would have exposed an upstream bedrock ledge, creating a new, larger obstruction to fish passage.

B&V developed a solution comprising the replacement of the existing weir/fish pass with a new 'rock ramp'. This represented the least cost solution to facilitate salmon migration, and allowed the channel to revert to a more natural state.

Keywords: Restoration; Geomorphology; Stream power; Fisheries; Abstraction; Rock-weir.

MORPHOLOGICAL ADJUSTMENT AND ECOLOGICAL RESPONSE TO TRIBUTARY RECONNECTION IN AN UPLAND RIVER

E. C. QUINLAN[1], C. N. GIBBINS[2], R. J. BATALLA[3] & D. VERICAT[3]

[1]*PhD student – Northern Rivers Institute, University of Aberdeen, Aberdeen AB24 3UF*
emmaquinlan@abdn.ac.uk
[2]*Senior Lecturer – Northern Rivers Institute, University of Aberdeen, Aberdeen AB 24 3UF*
[3]*Senior Lecturers – Dept. of Envt. and Soil Sciences, University of Lleida, E-25198 Lleida, Catalonia, Spain*

Abstract

The river Ehen, West Cumbria, designated as a Special Area of Conservation (SAC), is regulated naturally by Ennerdale Water. Engineering works constructed in the 1970s raised the level of the weir and allowed greater storage capacity in the lake and ensured a more secure potable water supply. As part of these works, one of the tributaries of the Ehen was diverted to Ennerdale Water, further supporting abstractions. As an important source of water and sediment to the mainstem channel has been disconnected, there are concerns that the tributary diversion may be compromising the ecological integrity of the river.

This poster describes work which aims to assess the effects of reconnecting the tributary to the Ehen. Assessment of tributary sediment yield will be coupled with digital elevation and hydraulic models of reaches in the Ehen downstream of the confluence, to assess the likely hydrologic, sedimentologic and geomorphic responses to reconnection. Continuously logging optodes installed within the stream bed at impact and reference sites will provide data on dissolved oxygen levels within the hyporheic zone; data will be used to assess how the suitability of conditions for invertebrates and salmonid eggs might be affected by the predicted hydrological and sedimentological changes.

Keywords: Tributary reconnection; Digital elevation models, Hydraulic models; Hyporheic zone

SOME SIMPLE TOOLS FOR COMMUNICATING THE BIOPHYSICAL CONDITION OF URBAN RIVERS TO SUPPORT HIGH-LEVEL DISCUSSIONS REGARDING RIVER RESTORATION

LUCY SHUKER

PhD researcher – Queen Mary, University of London, Mile End Road, London E1 4NS
l.shuker@qmul.ac.uk

Abstract

This poster illustrates a set of simple tools that may be used to assess the biophysical condition of river and riparian habitat in urban catchments. The tools are based upon information collected using the Urban River Survey (URS): a habitat survey designed for application to 500m stretches of urban river corridor. The poster compares examples of how these simple tools may be used to communicate information about urban river conditions at both reach and catchment scale to a wide range of non-technical stakeholders and local community members; to support high level discussions and decision-making relating to: initial site selection for restoration; to post project appraisal; WFD objectives for HMWBs and to contribute to the sustainable and integrated socio-environmental management of urban blue ribbon and green grid networks.

Example applications are provided using data from URS surveys undertaken on tributaries of the River Thames within London displaying a range of characteristics within both restored and un-restored stretches of modified river channel. These tools are being used in London as part of a broader interdisciplinary ESRC/NERC research project that is testing the suitability of this type of approach in the context of the London Rivers Action Plan, Water Framework Directive, urban blue space regeneration, place-making and climate change adaptation principles.

Keywords: Urban river restoration, habitat assessment, blue green connectivity, WFD, ecological potential, HMWB

NOTES…

SITE VISIT INFORMATION

(FRIDAY 15TH APRIL)

Croxall Lakes

A very large proportion, if not most, rivers in lowland England have been re-sectioned to a trapezoidal profile with very steep banks with an angle of 1:3-4. This cross section can be self maintaining where the channels were specifically designed to be "self-cleansing" i.e. not to allow deposition of gravel and silt. These channels were based on keeping the narrowest existing river cross section and making the whole river to that width. It has therefore become clear that the only way to create self sustaining in-stream habitat is to widen channels in such places. This re-establishes a more natural variation in channel width. This is most easily done on the inside of bends where it is possible to mimic a natural tick shaped channel profile by pulling back the bank. It became clear that the key factor in this was to increase the channel cross sectional area very considerably to allow slowing of flow, deposition of gravels, resulting in raising of bed levels creating riffles and thus kick starting the process of self restoration. This is of course in addition to the directly created habitats.

Earlier work at the site

Stage 1 (1997)

Along 400m of the Tame an underwater shelf about 4m wide was excavated to just below water level and the bank sloped back to an angle of 1:20 to a maximum of 30m at the point of the bend. The river in this reach had a very even width of about 25m before the works.

Stage 2 (2002)

It became clear that a larger increase in cross section at high flows would have been desirable. In 2002, the 400m of land between the river and the lake (an area of about 2.7ha) was lowered by 750mm. The highest point was lowered from 1.6 to about 0.85m above normal water level. The river height at bank full level was thus similarly lowered thus reducing velocity and thus increasing deposition on the bend. The soil was again put into the lake to create shallows.

Stage 3 (2008)

There was a 300mm pipe linking the pool at Croxall to the river. This was put in when gravel working on the site ceased. It allowed river water to enter and drain from the lake quite slowly, kept the lake level generally higher than the river and did not allow fish to move between the lake and the river. The poor in-channel habitat on the River Tame, combined with intermittent poor water quality events have retarded the development of sustainable fish stocks. To counter that the EA has created a series of "fish refuges/spawning areas" by linking pools to the river. In 2002 the pipe was replaced by a lower level open channel about 6m wide at bank top. This allows fish to enter and leave the pool and also lowered the lake level thus creating better shallows for waders.

Lessons Learnt

It became clear that the restoration works could have been even bolder by lowering the whole of the bend down to lake/river level. This experimental work on the Tame at Croxall gave confidence that widening, combined with allowing river processes to work was an answer to the problems of poor channel structure in gravel rivers. This confidence was part of the background to the much larger scheme carried out by the Wildlife Trust on the Tame/Trent at Croxall.

Latest Phase of Works at Croxall

The work was carried out by Nick Mott of Staffordshire Wildlife Trust in partnership with Lafarge Aggregates, Landfill Communities Fund, Natural England, The National Forest Company, the Environment Agency, Network Rail and May Gurney.

Aims

The main aim was to recreate some of the habitats which were once common features along our main rivers prior to their modification in the 19th and 20th centuries. The river has been heavily engineered in the past and was once much shallower and wider. The project aims at allowing natural river processes to occur by widening the channel (to over 90m in some places) encouraging it to become active in terms of deposition and bed-scouring.

Table 1 Scheme Summary

Works	Driver
540 metres of river re-habilitation	(UK & LBAP Target for Rivers)
1.85 ha area of river widening	(UK & LBAP targets for creation of new wetlands)
1.2 ha of shallows created for new reedbed planting	
Approximately 40,000 cubic metres (80,000 tonnes) of soil was removed from the riparian zone and transported to the lake deposition areas.	Baseline surveys carried out for UK & LBAP (& other indicator) species
Baseline geomorphological survey carried out including a 1D Hydraulic model	

The scheme cost £161,000 of which £144,000 was capital works.

Wildlife

Baselines survey information has been collated for a number of invertebrate, bird, amphibian, fish, mammal and plant species at Croxall. UK and Staffordshire BAP wetland species recorded within two kilometres and within the last ten years include: white-clawed crayfish, harvest mouse, otter, water vole, common toad, eel, barn owl, snipe, lapwing, reed bunting and native black poplar.

The UK BAP species, depressed (or compressed) river mussel has been recorded within three kilometres of the site. This is a species which is being targeted for specific survey work at Croxall to ascertain whether the habitats created during the scheme prove suitable for colonisation.

Now the works have been completed Stafforshire Wildlife Trust will be carrying out repeat surveys for BAP and other indicator species at the site. It should be noted that significant numbers of waders were recorded during and shortly after completing- the scheme. Snipe, lapwing, green sandpiper, common sandpiper and redshank were all frequent visitors to the new wetland area. Links with universities are in place to ensure that ongoing research and monitoring is carried out.

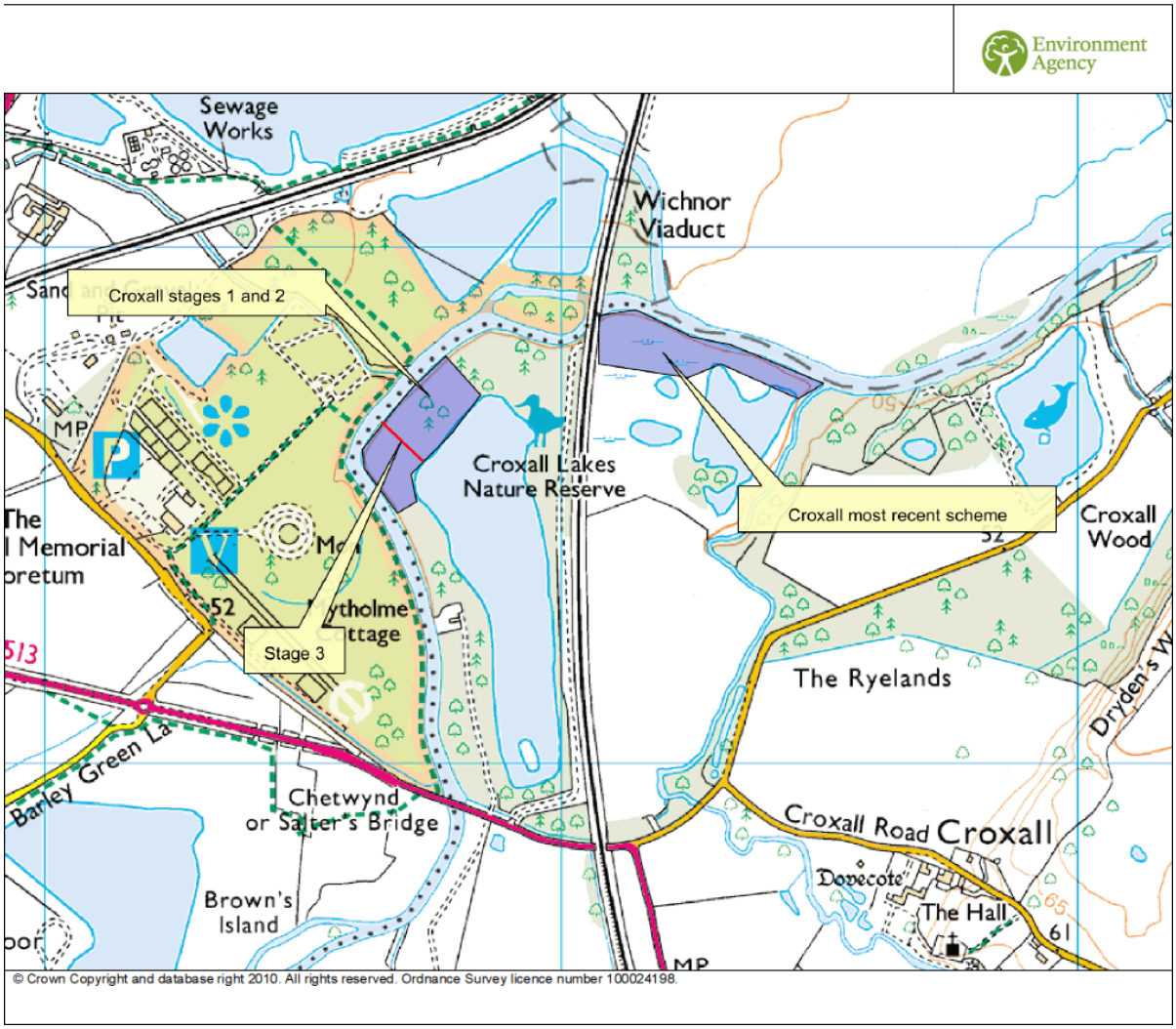

Figure 1 Croxall Lakes site map

Annotated aerial photo showing the scope of the works at Croxall Lakes. © The Environment Agency.

Figure 2 Aerial Photograph annotated with proposed works at Croxall Lakes

Figure 3 Widened channel with bars and islands at the Tame – Trent confluence

Figure 4 Islands being created

Tuckers Holt Farm

The River Sence at Tuckers Holt Farm has been extensively straightened due to mineral extraction and agricultural land gain. The land is owned by the Crown, but leased for farming and to Hansons Aggregates for clay extraction. Fishing rights along the river are also let out separately. There are no flooding issues, in terms of impacts on buildings or infrastructure.

Permission was gained from all the landowners and tenants and from the Environment Agency (Land drainage consent), to introduce randomly placed large woody debris. The wood was sourced from the Forestry Commission at Cannock and was placed in the channel to act as blockages/deflectors which would encourage more scour and deposition of bed and banks (see Figure 5). This was supplemented with 80 tonnes of river gravels to raise the river bed and create/ improve the habitat for white clawed crayfish, brown trout and grayling that are found further downstream.

The project was mostly funded by the Environment Agency Fisheries, but was carried out by the Wild Trout Trust. The £10k project was carried out in the spring of 2010 and will be further enhanced by a new weir bypass channel (see weir in Figure 6) at the same site. The bypass channel will enable the white clawed crayfish, trout and grayling to migrate upstream to other improving habitat which has been enhanced by further introductions of large woody debris. This Environment Agency £13k Biodiversity project is being carried out at the end of March 2011.

Figure 5 Large woody debris placed along river banks

Figure 6 Weir soon to be bypassed

Sence Valley Forest Park

This area of Sence Valley Park formed part of a large opencast mining area covering around 460 acres. Once coal extraction had finished in 1996, the soil was compacted and cultivated and a drainage system was installed. Leicester County Council were given 150 acres to create a forest park, and the park was opened as part of the National Forest in 1998 after being planted with more than 98,000 trees.

As part of the restoration work the River Sence, which had been diverted around the mine, was reinstated to its original position. The Coal Board had planned to reinstate the river in a trapezoidal channel, but the Environment Agency insisted on a more natural restoration.

The reinstated channel is largely constructed without bank reinforcement, although there are a few small sections where stones have been used for support. This has been successful, and there have been no major problems with erosion or collapse. The channel has naturally moved since its creation, with areas of erosion and deposition and the formation of berms and meanders.

The new channel was dug quite deep for flood risk reasons, and it is subsequently felt that a shallower channel with a higher bed level would be preferable. It is also recognised that fencing off the river bank to create a buffer strip between the farmland and the river would help to improve the water quality.

More recently further work has been carried out on the River Sence through Sence Valley Park. Working with the Forestry Commission and Sence Valley Volunteer Group, the Environment Agency have carried a project to enhance 600m of the artificial river channel that was formed 15 years ago as a narrow incised channel after extensive opencast coal extraction.

The £20k project was funded out of the FCRM Biodiversity project pot and resulted in WFD improvements through re-grading and widening of bends, adding large woody debris as flow deflectors and habitat diversity, cutting 2 new meanders (see Figures 7 to 9), and removal of an artificial rock chute weir that was impounding water and disrupting natural flows.

After discussions with Lafarge aggregates, they also agreed to be a partner in the project and supplied 100 tonnes of river gravels to help improve the bed structure, spawning quality and ecology of the restored section. Spoil from the works was lost in the margins of the adjacent lake to create shallows to enable BAP habitat (reedbed) creation by the volunteer group. A viewing platform has been created so visitors to the park can view the new river section and associated wildlife. This project co-ordinates well with those downstream at Tuckers Holt Farm and will allow brown trout and grayling to move upstream to establish and spawn, and so expand their current range.

Figure 7 Pre-works

Figure 8 New meander being excavated

Figure 9 New meander

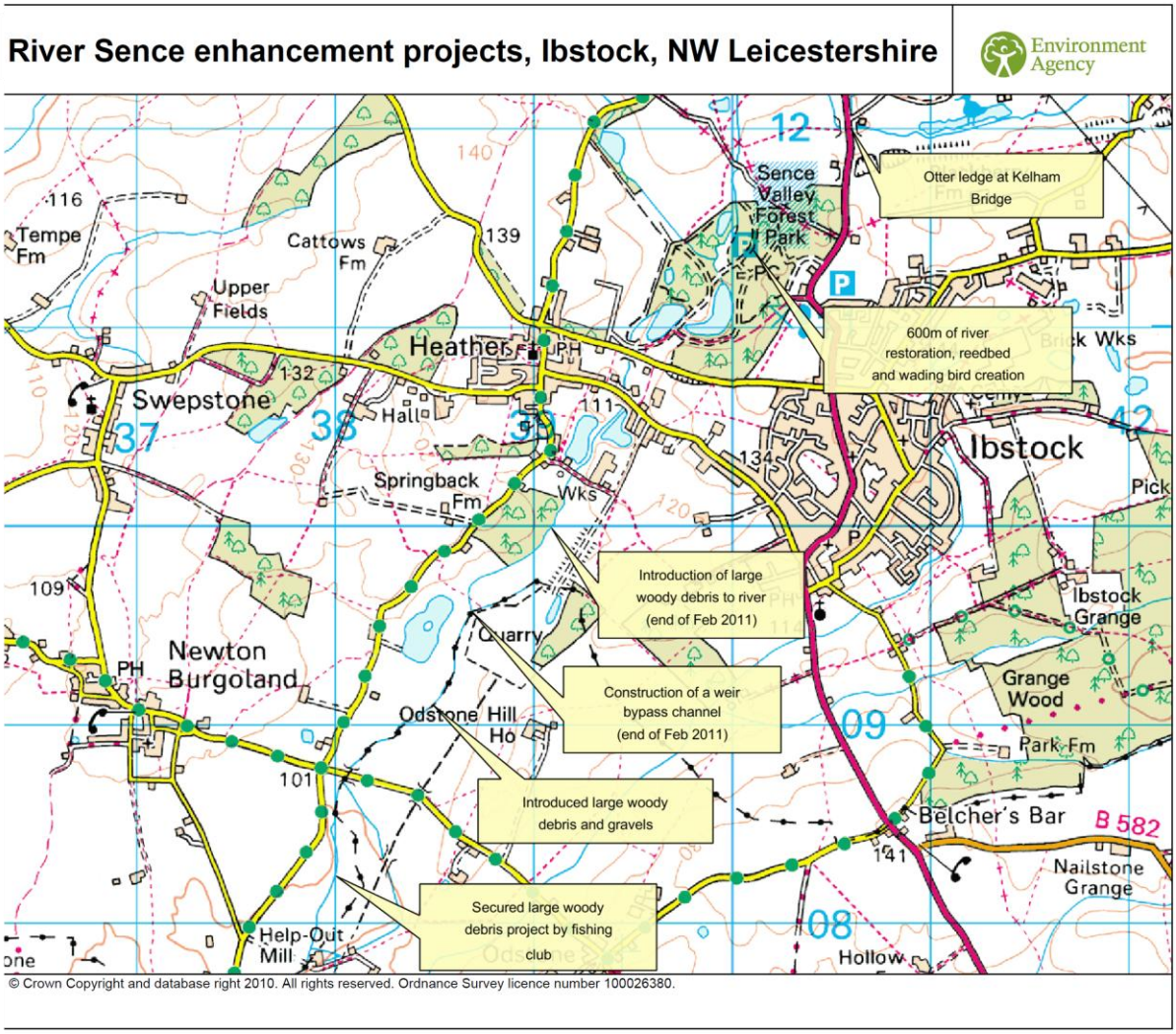

Figure 10 Sence Valley Forest Park site map

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