Case study #. Evenlode Catchment Project

Author: Jo Old

Main drivers: Flood risk (small rural communities), rural diffuse pollution (Water Framework Directive water quality failures) and habitat (Water Framework Directive fish failures)

Project stage: Year 1 of a 5-year (2016 to 2021) Natural Flood Management project; first cycle of consultation and design for tributary interventions completed, with construction planned in 2017

Photo1&2: Natural Flood Management at Honeydale Farm and a leaky dam in the Littlestock Brook

Project summary:

The River Evenlode, a headwater tributary in the Thames Basin (Map 1), is a flashy clay catchment with several small rural towns and villages prone to flooding. The Environment Agency is working with the Evenlode Catchment Partnership and local communities to develop and coordinate a 5-year project that integrates Water Framework Directive (WFD) objectives with a Natural Flood Management (NFM) demonstration scheme. The natural solutions to manage floodwaters often require land management changes to slow and store run-off, which can have multiple benefits for water quality and habitat creation, and drive improvements in agricultural land management.

In Year 1 of the project, a tributary catchment (16.3km²) trial in Littlestock Brook was set up with key landowners and Evenlode Parish Council. Opportunity mapping, site walkovers and modelling are being used to plan and implement a suite of NFM/WFD measures such as creating temporary water retention ponds in field corners, constructing bunds and scrapes to store more floodwater on grassland areas, installing woody debris in-channel to create leaky dams, and creating riparian woodland.

A project officer employed by the Evenlode Catchment Partnership in 2017 will work with partners to implement NFM and WFD opportunities across the 180km² Upper Evenlode catchment. A key objective is to ensure full integration with Thames Water’s phosphate reduction project and Natural England’s Catchment Sensitive Farming Officer if opportunity mapping directs the project to work in the same tributaries of the Evenlode.
Key facts:

The results from this first NFM trial in the Thames Basin will contribute to the call nationally for evidence on the effectiveness of natural measures for flood risk. Through an academic partnership, a river level and turbidity monitoring network has been installed in Littlestock Brook and a long profile survey conducted prior to constructing a woody dam. The plan is to engage the community to actively support this monitoring network. A key objective of this project is to determine whether multiple small-scale NFM interventions in these catchments can provide a material benefit to flood frequency and extent.

For these natural solutions to be successful, it is crucial to empower the community in decision-making and for them to take ownership of the local solutions employed. Employing an NFM project officer to work with the Evenlode Catchment Partnership is fulfilling Defra’s ambition to develop community-driven, catchment-based solutions to environmental issues through the forum of catchment partnerships.

Map 1: Location of Evenlode catchment (source: Environment Agency)

1. Contact details

<table>
<thead>
<tr>
<th>Contact details</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Names:</td>
<td>Jo Old (Environment Agency), David McKnight (Environment Agency) and Hilary Phillips (Wild Oxfordshire)</td>
</tr>
<tr>
<td>Lead organisations:</td>
<td>Environment Agency and Wild Oxfordshire</td>
</tr>
<tr>
<td>Partners:</td>
<td>Evenlode Catchment Partnership Steering Group – West Oxfordshire District Council, Costwold Rivers Trust, Windrush AEC Ltd, Wychwood Project and an independent hydrologist</td>
</tr>
</tbody>
</table>
Catchment partnership members – Cotswolds Rivers Trust; Berks, Bucks and Oxon Wildlife Trust; Forestry Commission; Sylva Foundation; Centre for Ecology and Hydrology (CEH); Cotswolds Area of Outstanding Natural Beauty (AONB); Natural England; Thames Water Utilities Limited, Upper Thames Fisheries Consultative; Combe Mill Education Centre at the Blenheim Estate.

Landowners
Parish councils

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david.mcknight@environment-agency.gov.uk
hilary@wildoxfordshire.org.uk

2. Location and catchment description

Catchment summary

<table>
<thead>
<tr>
<th>National Grid Reference:</th>
<th>SP27201860 (centred on Milton-under-Wychwood)</th>
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<tbody>
<tr>
<td>Town, County, Country:</td>
<td>Milton-under-Wychwood, Oxfordshire, UK</td>
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<tr>
<td>Regional Flood and Coastal Committee (RFCC) region:</td>
<td>Thames</td>
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<td>Catchment name(s) and size (km²):</td>
<td>Evenlode (approximately 430km²)</td>
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<tr>
<td>River name(s) and typology:</td>
<td>Headwater tributaries such as Littlestock Brook (active pool-riffle channel) and main River Evenlode (inactive single thread channel)</td>
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<tr>
<td>Water Framework Directive water body reference:</td>
<td>Year 1 in 29910 and 29960 (Years 2 to 5 extending through Upper Evenlode waterbodies 37410, 37420, 37400, 37390, 30000, 29980, 29950)</td>
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<tr>
<td>Land use, soil type, geology, mean annual rainfall:</td>
<td>Largely agricultural catchment (49% arable, 32% grassland, 14% woodland, 1.4% urban extent) with scattered settlements</td>
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<td></td>
<td>Headwaters largely impervious (Lias Series), lower Evenlode reaches pervious Oolitic limestone geology</td>
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<td>Average annual rainfall: ~700mm (source: National River Flow Archive)</td>
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3. Background summary of the catchment

Socioeconomic/historic context

Like many agricultural catchments, the Evenlode catchment has a legacy of widespread land drainage operations which has resulted in the river channels being straightened, becoming over wide or over deep, and disconnected from their floodplains. A history of milling has left several barriers to fish passage and perched, uniform mill leat channels. The flashy, clay soils in the headwaters of the Evenlode have been extensively underdrained for agricultural productivity, which may increase the responsiveness of the catchment to rainfall.
Flood risk problem
The Evenlode is a very rural catchment with a responsive flow regime (as indicated by the low Baseflow Index of 0.71 given for Cassington Mill gauging station). It has just 2 significant riparian settlements – Moreton-in-the-Marsh (population 3,493 in 2011) and Charlbury (population 2,830 in 2011). The rest of the catchment’s population is dispersed into many small riparian towns and villages, which are prone to flooding, such as the Wychwoods (Milton, Shipton and Ascott) in the middle Evenlode. Four properties flooded in 1990 and 1998, and 318 properties suffered fluvial flooding in 2007, with additional property flooding attributed to groundwater and surface water sources. Critical infrastructure that may be subject to flood risk includes the Oxford–Worcester railway line which follows the course of the Evenlode for the length of the catchment. Several bridge crossings include Charlbury, which was damaged in the 2007 flood. A residential home situated in the flood zone at Shipton-under-Wychwood was evacuated in 2007.

Property level protection and a flood storage area (FSA) were installed after 2007 to reduce the flood risk to 7 houses in Milton-under-Wychwood on the Littlestock Brook. Despite these measures the community still feels vulnerable to flooding from the very responsive headwater tributary.

Other environmental problems
In 2016, only one water body in the Evenlode catchment was achieving ‘good ecological status’. Ten were failing for water quality (phosphate) due to sewage effluent and rural diffuse inputs. Seven water bodies had failing fish populations due to a combination of poor habitat and barriers to fish passage. Poor habitat is reflective of the uniform and disconnected channel morphology resulting from a history of land drainage. A further issue, evident in the Littlestock Brook, is the excessive production of coarse bed material resulting from channel incision as the river responds to historical realignment away from its natural valley bottom. The downstream transport of this bed material by the flow into the constrained channel of Milton-under-Wychwood further reduces its capacity for peak flows.

4. Defining the problem(s) and developing the solution
What evidence is there to define the flood risk problem(s) and solution(s)
This NFM/WFD project is community driven and is being implemented through a catchment partnership. The small rural communities in the Evenlode catchment are aware of their own flood risk and the inability to attract traditional flood prevention infrastructure. The Evenlode Catchment Partnership has been working with individual landowners on the main Evenlode to install NFM measures on a field scale such as at Honeydale Farm (Photo 1) and on river restoration to increase floodplain connectivity (Photo 3). Residents in the local villages became interested in these solutions and, through their parish councils, have engaged with the Evenlode Catchment Partnership to trial NFM measures.

Photo 3: River restoration on the Evenlode
The flooding/near flooding experiences of the residents of Milton-under-Wychwood generated a wealth of photographic and anecdotal evidence. A study commissioned by the residents suggested flooding had occurred due to a combination of the restrictive size of the road bridge arch, an accumulation of coarse gravel reducing channel capacity (Photo 4) and a very responsive flow regime.

**Photo 4: Accumulation of coarse gravel reducing channel capacity**

Following the 2007 flood event, an overflow for floodwaters into a bunded field was created 1km upstream (Brurn Grange FSA), property level protection measures were installed and works to improve conveyance at the road bridge took place. Most recently, the parish council commissioned upstream bank re-profiling work to reduce bank erosion and the suspected source of coarse gravel (Photo 5). Since engaging with the Evenlode Catchment Partnership, the parish is now keen to trial alternative NFM solutions throughout the tributary catchment area (Map 2), with an initial 12 woody dams installed in March 2017 to reduce the transport of coarse bed material (Photo 2).

**Photo 5: Visit to view suspected source of coarse gravel**

Although the project does not yet have quantitative evidence to show what extent the different NFM measures installed throughout the headwater catchment will have on the flow regime of the catchment, the community is content with a ‘no regrets’ logic in that measures to slow and store surface run-off should, cumulatively, help to reduce flood risk. The parish is very interested and excited to be part of a trial to better understand the value of NFM. Residents are also aware of the additional benefits for water quality and habitat quality through reducing the sediment and nutrient loading to the rivers from agricultural run-off.

**What was the design rationale?**

A tributary catchment (16.3km²) trial in Littlestock Brook was set in Year 1 of the project with the most important landowners and the parish council. Catchment walkovers directed by surface water flow maps (Photo 6) are primarily being used to identify significant run-off pathways with the landowners (Photo 7). Based on the observations during these visits, discussions are held with the landowners as
to which NFM/WFD measures would work both hydrologically to store flow and to fit with their farming business. Map 2 shows the potential suite of measures which the landowners are considering such as:

- creating temporary water retention ponds in field corners
- constructing bunds and scrapes to store more flood water on grassland areas
- installing woody debris in-channel to create leaky dams
- creating riparian woodland creation

Photo 6: Surface water flow map

Photo 7: Site walkover with landowners

In addition, there is a hydraulic model available for part of the Evenlode catchment. This, together with opportunity mapping and hydrological assessments of storage volumes, will be used to test the potential effectiveness of different NFM measure scenarios, in particular the modification and extension of the existing FSA. The results will enable the project team to select the most suitable locations for NFM measures in the remaining 180km² upper Evenlode catchment for implementation in Years 2 to 5 of the project.
5. Project construction

How were individual measures constructed?
The implementation of NFM interventions is planned through the Evenlode Catchment Partnership, making best use of local contractors and locally sourced materials. An example is the use of felled tree stock provided by local landowners and tree surgeons to construct 'leaky dams'. West Oxfordshire District Council provides engineering oversight where appropriate. Match funding and in-kind contributions have already been secured from landowners and will be sought in the future through stewardship/woodland planting grants.

How long were measures designed to last?
Information not available at this time as we are still deciding on types of measures to implement.

Were there any landowner or legal requirements which needed consideration?
Landowner negotiations are required. It is also necessary to consider future liabilities such as public liability/ownership of woody dams.
Landscape considerations apply in the Cotswold AONB especially in terms of woodland planting.
### 6. Funding

#### Funding summary for Working with Natural Processes (WWNP)/Natural Flood Management (NFM) measures

<table>
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<tr>
<th>Year project was undertaken/completed:</th>
<th>2016 to 2021</th>
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<td>How was the project funded:</td>
<td>Thames RFCC Local Levy: £230,000 over 5 years</td>
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<td>Flood and Coastal Risk Management Flood Defence Grant-in-aid (FDGiA): £20,000</td>
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<td>Water Framework Directive FD FDGiA: £150,000 over 5 years</td>
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<td></td>
<td>Parish Council: £5,000</td>
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<td>Cotswold River Trust: £25,000</td>
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<td>Landowners: £50,000</td>
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<td>Total cash cost of project (£):</td>
<td>£480,000 (this figure is likely to increase as project evolves)</td>
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<td>Overall cost and cost breakdown for WWNP/NFM measures (£):</td>
<td>Funding of project officer post: £200,000</td>
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<td>NFM measures and monitoring/modelling: £280,000</td>
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<td>WWNP/NFM costs as a % of overall project costs:</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Unit breakdown of costs for WWNP/NFM measures:</td>
<td>Not applicable</td>
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<tr>
<td>Cost–benefit ratio (and timescale in years over which it has been estimated):</td>
<td>This project seeks to implement small-scale catchment wide interventions over a period of 5 years. Over this period the number of interventions put in place will build into a quantifiable mosaic of catchment solutions. In isolation these interventions are only likely to have minor effects, making it difficult to measure their benefit.</td>
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### 7. Wider Benefits

Not applicable – this is only Year 1 of the project so this information is not yet available.

### 8. Maintenance, monitoring and adaptive management

**Are maintenance activities planned?**

Maintenance and ownership will remain with the riparian landowner. However, the partnership – including the parish council and landowners – are content to monitor the condition of the interventions. Adaptive maintenance will be required as there are a wide range of interventions, materials and methods of construction, resulting in a varied lifespan of any measures. Once constructed, interventions will be added to a register to allow for inspection and maintenance where required.

**Is the project being monitored?**
River level monitoring (Photo 7) has been installed in 3 locations by the Environment Agency's Hydrometry & Telemetry team and CEH, with additional monitoring of individual interventions planned as the project progresses. A base-line bed profile survey has been completed prior to the leaky dam installation in the Littlestock Brook. Community engagement in the monitoring is being promoted through the Evenlode Catchment Partnership. This will hopefully enable the timing of flow peaks to be observed/photographed and additional parameters such as phosphate and invertebrate species to be monitored. Thames Water have instrumented three other waterbodies in the Upper Evenlode as part of their linked phosphate reduction project. Short and long-term student projects are also being pursued. The results of this monitoring and modelling programme will provide a measure of how effective this project has been on reducing flood flows and peaks (peak flow, time-to-peak, desynchronisation), flood storage volumes, sediment delivery and the number of properties at risk of flooding.

Photo 7: River level monitoring

Has adaptive management been needed?
Not applicable – this is only Year 1 of the project.

8. Lessons learnt

What was learnt and how could it be applied elsewhere?
This project is still very much in the development stages. However, it is clear that it takes considerable time to develop relationships with landowners and the community. It also takes time to work through the sometimes conflicting site-specific constraints to find the optimum solution. The success factor for this project has been the established relationships and trust between the catchment coordinator and the host organisation (Defra's catchment-based approach). This has allowed the development of a cost-effective delivery model that maximises the potential for local priorities with multiple benefits.

9. Bibliography
Not applicable

Project background
This case study relates to project SC150005 'Working with Natural Flood Management: Evidence Directory'. It was commissioned by Defra and the Environment Agency's Joint Flood and Coastal Erosion Risk Management Research and Development Programme.