Case study 3. River Avon Restoration Project

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Main driver: River restoration

Project stage: Construction phase (multi-site, 2011 to 2017)

Photo 1: Norton Bavant, River Wylye, Wiltshire (source: Environment Agency)

Project summary:

The River Avon is one of the most important river systems in the UK, supporting internationally and nationally important habitats and species. The river is designated as the River Avon System Site of Special Scientific Interest (SSSI). The SSSI covers the River Avon, its major tributaries and parts of the floodplain. The River Till, a tributary of the River Wylye, is designated as a separate SSSI. Habitats associated with the river include swamp, wet woodland and wet grassland habitats.

The River Avon System SSSI and River Till SSSI are also designated internationally through the Habitats Directive as a Special Area of Conservation (SAC). The SAC supports internationally rare and threatened species.

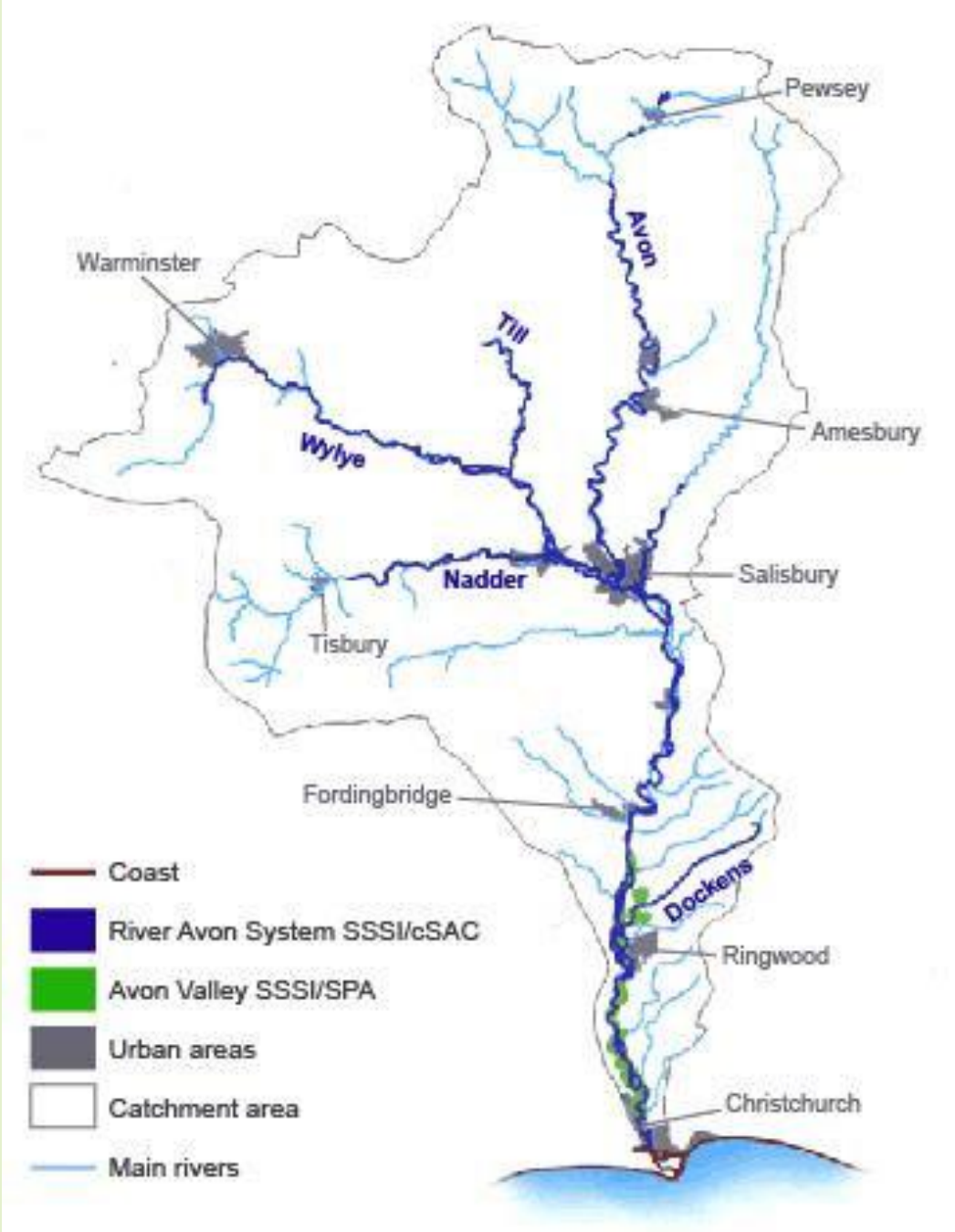
The lower reaches of the River Avon and its floodplain, one of the largest expanses of unimproved floodplain grazing marsh in Britain, are designated as the Avon Valley (Bickton to Christchurch) SSSI. The area is also a Ramsar site and a Special Protection Area (SPA). It supports a complex mosaic of wetland habitats including fens, mires, wet grassland, wet woodland and unimproved floodplain grassland. Important species include populations of breeding and over-wintering wetland birds, and rare wetland plants and insects.

A strategy was developed to determine the issues affecting the river's geomorphological functioning and associated condition of the various designations. Based on this strategy, the River Avon Restoration Project was developed to identify measures to restore the river on a reach-by-reach basis. The Environment Agency agreed with Natural England to undertake the more complex measures and reaches, with the Project Board supporting project partners and other interest groups to put in place less complex measures where required.

The River Avon Restoration Project is primarily a catchment-scale river restoration strategy. However, some of the individual completed projects can also be considered as delivering Natural Flood Management (NFM) benefits. This is because they are principally Working with Natural Processes (WWNP), creating a more naturally connected and functioning river and floodplain.

Key facts:

No irrefutable facts on flood risk are currently available. The projects reconnecting river and floodplain are assumed to have small flood risk benefits. If multiple projects are carried out, the accumulative benefits from more measureable flood risk benefits would be observed by communities. It was not considered cost-effective to conduct detailed modelling (other than for the Wilton Hatches project – see below) as the River Avon Restoration Project is principally about river restoration and habitat enhancement.



Map 1: Hampshire Avon System SSSI and SAC (source: Environment Agency)

1. Contact details

Contact details	
Names:	Mike Porter, Alasdair Maxwell, Dianne Matthews, Fergus Mitchell, Simon Curzon
Lead organisations:	Environment Agency, Natural England
Partners:	Hampshire Wildlife Trust, Wessex Chalk Streams and Rivers Trust, Wessex Water, Wiltshire Fisheries Association, Wiltshire Wildlife Trust
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2. Location and catchment description

Catchment summary	
National Grid Reference:	SU1323755959 - SZ1776591737
Town, County, Country:	(multiple towns) Wiltshire and Hampshire, UK
Regional Flood and Coastal Committee (RFCC) region:	Wessex
Catchment name(s) and size (km^2):	Hampshire Avon, 1,750km^2
River name(s) and typology:	River Avon, active meandering River Nadder, active meandering River Wylye, active meandering River Till, active meandering (part winterbourne) The Bourne, active meandering (part winterbourne) Dockens Water
Water Framework Directive water body reference:	GB108044009690
Land use, soil type, geology, mean annual rainfall:	Mixed arable and pasture, deep loamy or sandy clays, shallow silts and clays, and loams over chalk, predominantly chalk in upper reaches including green sand with sand, gravels and clays

3. Background summary of the catchment

Socioeconomic/historic context

The River Avon and its tributaries have been shaped and influenced by a long history of human use. Its many and diverse uses continue to influence management of the Avon and are integral to the landscape, heritage, social and economic value of the river.

Although the main channels of the River Avon have seen little natural change in course over the past 1,000 years, there have been historic modifications for mills and water meadows which have clearly contributed to the ecological communities that are valued today. However, in more recent years (since the mid-1940s) flood defence, land drainage, urban development and agricultural intensification have

resulted in major impacts on rivers, streams and floodplains. The River Avon is also affected by pressures within the catchment, such as changing land use and land management practices which affect water quality and sediment loads.

Flood risk problem(s)

Both fluvial and groundwater flooding occurs on the Hampshire Avon and its major tributaries. Despite being a mostly groundwater-fed chalk river, it can also respond in a more flashy nature to heavy rainfall events, particularly the River Nadder and especially when the groundwater level is high. Above Salisbury the communities most at risk of flooding are small, and groundwater poses the greater risk. Former mills especially on the Nadder are mostly at risk. Wilton (Nadder) and Salisbury (Nadder and Avon) are at significant risk, particularly during long duration high groundwater events and combined with heavy rainfall events in the flashier upper Nadder catchment. Downstream of Salisbury to Christchurch, a number of communities are at risk including infrastructure.

Other environmental problems

Historic activities such as milling and water meadows, together with river dredging for land drainage, have disconnected the river and floodplain (by lowering the bed and raising embankments), trapped sediment within the river channel, reduced the ability for fish to migrate and disconnected river habitats. Land drainage and disconnecting floodplains have reduced the extent and quality of wetland habitats.

4. Defining the problem(s) and developing the solution

What evidence is there to define the flood risk problem(s) and solution(s)

Not available

What was the design rationale?

The aim was to provide a flexible and sustainable river and floodplain design to reconnect the river and floodplain through targeted removal of existing raised embankments, structures and in-channel works.

Project summary	
Area of catchment (km^2) or length of river benefitting from the project:	150km of direct improvement but the 300km of the SSSI and SAC will receive overall improvement
Types of measures/interventions used (WWNP and traditional):	River restoration, embankment removal / lowering, structure removal, reduced in-channel vegetation management, arable reversion
Numbers of measures/interventions used (WWNP and traditional):	
Standard of protection for project as a whole:	There has been no significant improvement in the standard of protection due to this project, but no detriment either.
Estimated number of properties protected:	No estimate of properties protected has been produced for any projects within the River Avon Restoration Project.

How effective has the project been?

The catchment-wide strategy has identified a range of projects to contribute to the favourable condition of the SSSI and SAC, and working towards 'good ecological status' under the Water Framework Directive. These projects also seek to deliver multiple benefits such as improved fishing access and reduced flood risk.

The key projects delivered so far that can also be considered as WWNP/NFM are:

- **Hurdcott Hatches**: Approximately 1km of river channel improved with reprofiled banks, allowing improved river and floodplain connection. Large woody debris was introduced to create diverse flow patterns and to redistribute river gravels so as to create diverse habitats and help slow down bankfull flows.
- **Norton Bavant**: Remeandering of straightened mill leat. A new 200m channel in a more natural suitable location in the floodplain – bypassing the former mill – was created, allowing naturalised river and floodplain reconnection.
- **Charlton St Peter**: Removal of 200m of raised embankment to reconnect the river and floodplain.
- **Wilton Hatches**: A new channel was created to bypass existing hatches, improving fish passage and reconnecting the river to the floodplain more naturally. Modelling was conducted because of the proximity of the scheme to existing flood defences in Wilton town centre. Modelling showed a slight decrease in flood levels at defences for a 100-year return period flood and deeper floodplain inundation upstream of Wilton.

5. Project construction

How were individual measures constructed?

Individual projects are implemented by the Environment Agency Field Services, Environment Agency Minor Work Framework Contractors (and subcontractors) or by partners using volunteers or small local specialised contractors. Heavy plant and machinery are often used for the more complex projects, while some in-channel measures such as the installation of large woody debris are done manually.

How long were measures designed to last?

Not applicable

Were there any landowner or legal requirements which needed consideration?

Each project carried out as part of the strategy required extensive landowner, tenant and fishing club negotiation and signup before they could begin.

6. Funding

Funding summary for Working with Natural Processes (WWNP)/Natural Flood Management (NFM) measures	
Year project was undertaken/completed:	2011 to 2017 (Phase 1 of Environment Agency funded part of wider catchment improvement)
How was the project funded:	Wessex Flood Defence Grant-in-Aid
Total cash cost of project (£):	£4.3 million (funding Phase 1 of Environment Agency contribution to wider catchment improvement)
Overall cost and cost breakdown for WWNP/NFM measures (£):	Most of the NFM related projects were undertaken by Environment Agency Field Services teams. Costs for their individual activities are not usually broken down. A cost estimate is given based on the expected duration of the overall project and it is difficult to cost for individual activities.

WWNP/NFM costs as a % of overall project costs?	Not able to provide
Unit breakdown of costs for WWNP/NFM measures:	Not able to provide
Cost–benefit ratio (and timescale in years over which it has been estimated):	Not able to provide

7. Wider benefits

What wider benefits has the project achieved?

Reconnecting the river and floodplain could contribute to managing diffuse pollution (sediment, phosphate and nitrogen) – an issue from which the River Frome also suffers – as reconnection will allow floodplains to be inundated and the silt load to accumulate on the fields. This benefit is predominantly related to arable land use further up in the catchment and outside the SSSI. It could also help contribute to improving water quality within Poole Harbour (into which the Frome flows).

Reconnecting rivers and floodplain could also help to create new or improve existing wetland habitats such as wet woodland and fen.

How much habitat has been created, improved or restored?

By 2017:

- 50km of improved chalk river habitat including improved fish and eel passage
- 10ha of wetland habitat

8. Maintenance, monitoring and adaptive management

Are maintenance activities planned?

Most river restoration projects require minimal maintenance and management. Fishing clubs will generally take on most management requirements.

Is the project being monitored?

Fixed point photography is the key monitoring approach, although Natural England will be conducting river habitat surveys at agreed times to determine the relative favourable condition of the SSSI.

Biotope mapping has been performed at the Mount Mill, Norton Bavant and Hurdcott Hatches projects as a pre-works baseline. There are plans to undertake repeat surveys to demonstrate geomorphological change and improvement post-project.

Electrofishing surveys were made at the Mount Mill project before and after a weir was removed to demonstrate improved salmonid fish passage and habitat connectivity.

Time-lapse cameras were used at the Hurdcott Hatches and Norton Bavant projects during and after the work to show how the removal of embankments or the creation of new channels had improved floodplain connection during high/out of bank flows.

Has adaptive management been needed?

None required

9. Lessons learnt

What was learnt and how could it be applied elsewhere?

River restoration projects generally need to be bold to ensure benefits are long lasting. Large woody debris needs to be robust to survive flood events and long lasting to maintain the effects.

Landowners and managers need to be made fully aware of the direct and indirect consequences of projects, especially those reconnecting floodplains. Downstream or adjacent landowners may also need to be consulted as flood flows are likely to cross land boundaries.

Provided flood risk to property or infrastructure is low, the available budget should be directed towards greater delivery and a lighter touch appraisal and design.

The modelling undertaken for the Wilton Hatches project could be used as an example in other projects, reducing the requirement for repeat modelling elsewhere.

10. 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.