Case study 23. Swindale Valley, Haweswater

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Main driver: Habitat

Project stage: Constructed, research underway on effects

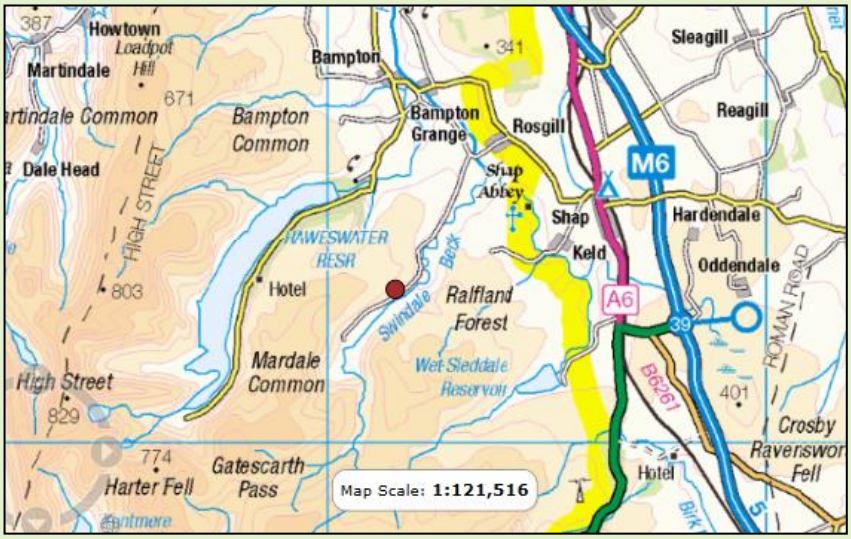
Photo1. Swindale Beck river restoration (Source: Case Study: Swindale Beck restoration**)**

Project summary:

RSPB, United Utilities, the Environment Agency and Natural England are working in partnership on a range of projects in the Swindale Valley near Haweswater in the Lake District. Together they are testing and demonstrating land management approaches to achieve improved outcomes for wildlife, water quality and downstream flood risk within a farmed landscape. So far 1km of heavily modified river, 1,000ha of bog and 15ha of species-rich hay meadow have been restored and new woodland has been established. They are currently investigating the feasibility of establishing two temporary flood storage areas at the head of the valley to determine the impact on downstream peak flows. A critical element of the approach is building relationships with academic institutions so that the impact of the interventions on a range of outcomes can be better understood.

Key facts:

- 1,140m restored river channel
- Levees removed to improve connectivity between channel and flood plain
- 40,000 trees planted within the catchment
- 3,000 trees planted along the river channel
- Work with Leeds, Glasgow and Salford universities and the JBA Trust to understand and quantify the impact these interventions have on downstream flows



Map 1: Location of Swindale Valley **(source: © Crown Copyright)**

1. Contact details

Contact details	
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2. Location and catchment description

Catchment summary	
National Grid Reference:	NY 522137
Town, County, Country:	Rosgill, Cumbria
Regional Flood and Coastal	North West

Committee (RFCC) region:	
Catchment name(s) and size (km^2):	Swindale Beck, 23 km^2
River name(s) and typology:	Swindale Beck, previously artificial drainage channel being restored to wandering channel
Water Framework Directive water body reference:	Swindale Beck (Lowther) GB102076070670
Land use, soil type, geology, mean annual rainfall:	Large parts of the catchment are unenclosed common land, including extensive peat soils. There is established native broadleaved woodland. Much of the Swindale Valley is managed as inbye, and includes several regionally and nationally important hay meadows. Geology is predominantly of the Borrowdale Volcanic Group.

3. Background summary of the catchment

Socioeconomic/historic context

The human influence on the Swindale Valley has largely been through farming. The river channel is heavily modified, with the primary purpose being to create and drain meadows for livestock grazing and hay cutting. The 1859 Ordnance Survey map shows the river already following its modified course. Stone walling both sides of the river has been effective in maintaining the artificial channel; 2km of levees built up, formed over the years through the removal of material from the river bed.

One of the key objectives in Swindale is to demonstrate that restoring river channels is compatible with maintaining the role of the valley bottom in the farm operation.

Flood risk problem(s)

Although there are no properties at risk of flooding from Swindale Beck itself, it flows into the Lowther which has contributed to flooding downstream at Eamont Bridge, a village south of Penrith. One of the project's aims is to understand the contribution that slowing flows in the Swindale catchment could have on risk in the wider catchment as well as demonstrating techniques that might be more widely applicable.

Other environmental problems

The partnership between United Utilities and RSPB at Haweswater originally came about because both organisations believe that improving the way catchments are managed could benefit wildlife and water quality. Swindale Valley retains a cover of ancient semi-natural woodland and a suite of nationally declining woodland birds, as well as rare plant, fungi and invertebrate communities. Expanding woodland cover will benefit wildlife but will also provide water quality benefits. Similarly restoring peat soils will allow the recovery of blanket bogs and mires but will also help to prevent increases in water colour, which benefits United Utilities' customers. The river restoration was primarily driven by a desire to improve the biodiversity value of the valley, but it will also encourage the deposition of sediment within the valley, reducing the costs associated with sediment removal at the United Utilities abstraction point downstream.

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

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

The importance of Swindale Beck in contributing to the drinking water network means that there is a relatively long run of detailed flow data, making it possible to determine through modelling and field measurements, with a reasonable degree of confidence, the impact of interventions on downstream flows.

Wider catchment modelling has been carried out by the Environment Agency and should enable the project team to model the impact of scaling up land management approaches.

Because of the significant biodiversity and water quality drivers, it has been possible to implement measures without needing to demonstrate the contribution to flood risk reduction. This makes it possible to design and test the beneficial impact of changes in land management on downstream flood risk of a range of measures that would not be likely to have been funded for their flood risk benefit alone.

What was the design rationale?

As above, the primary drivers for most of the management carried out to date have been the recovery of declining wildlife and improvements to raw water quality. As such there has been no deliberate attempt to date to map these interventions where they will have the greatest impact on slowing flows.

There has been a growing recognition that changing the way catchments are managed could, in many situations, reduce the flood risk for communities downstream. Academic institutions were therefore invited to use the site to contribute to the growing body of evidence around Natural Flood Management (NFM).

The potential impact of 2 temporary flood storage areas on downstream flows following extreme rainfall events is currently being modelled. By raising the bed of the river and making use of natural constrictions in the head of the valley, it is believed that the rate at which water flows down the valley could be reduced for a relatively low capital cost. Due to the small contribution this water makes to critical pinch points in the catchment downstream, it is not expected that the flood risk reduction will be significant on its own but, if the concept works, then the approach could be applied more widely and scaled up.

Project summary	
Area of catchment (km^2) or length of river benefitting from the project:	$23km^2$ Swindale catchment Not yet known what the benefit is downstream – modelling is underway
Types of measures/interventions used (Working with Natural Processes and traditional):	Livestock reduction Tree planting River walls and levees removed Remeandering and reconnection with floodplain Temporary flood storage areas
Numbers of measures/interventions used (Working with Natural Processes and traditional):	1,140m river restored 40,000 trees planted 1,000ha bog hydrology restored
Standard of protection for project as a whole:	Not yet known
Estimated number of properties protected:	Up to 150 properties at risk of flooding at Eamont Bridge – 105 homes and businesses in Eamont Bridge and Brougham were flooded following the 2015 storms Modelling is being carried out to determine the impact of the interventions alone but it is expected that approaches would have to be applied more widely within the catchment to deliver a significant reduction in flood risk.

How effective has the project been?

RSPB, United Utilities and the partners working with them in Swindale and the wider Haweswater estate are building up an evidence base to better understand the impact of their work on downstream flood risk.

This work includes:

- a PhD project6 with Leeds University looking at the role of established broadleaved woodland, including associated ground cover on flows
- work with Glasgow and Salford universities to understand the geomorphological change associated with the river restoration work, including using drones to capture changes in bed profile and sediment transport
- modelling to assess the feasibility and contribution that new flood attenuation structures could make to downstream flows after extreme rainfall events
- 4 new stage loggers to monitor small-scale in-stream responses to rainfall events, designed to complement the established flow monitoring carried out by United Utilities downstream
- various activities to understand the impact of the same measures on birds, fish and aquatic invertebrates

5. Project construction

How were individual measures constructed?

River restoration

A specialist environmental contractor, OpenSpace, won the tendering process and started work onsite in March 2016. The presence of field drains and high rainfall before and during the work, as well as the predominance of fine silts along the new route, made progress slow and meant that additional measures had to be incorporated to prevent silt run-off into the beck.

The relative paucity of gravels in the new river bed along several sections raised concerns about the short-term stability of the river system and so a small number of embryo gravel bars were constructed in areas where it was felt they would eventually form naturally.

Shortly after the new channel was connected a very heavy rainfall event resulted in the flooding of the valley. There was some concern about the impact of this on the unconsolidated new banks but in fact the event had redistributed gravels along the new river section and created new gravel bars and pools.

The new channel is 140m longer and 2m wider than the old one.

How long were measures designed to last?

It is expected that the new river channel will be considerably more dynamic than the old one and will not retain the same channel indefinitely. This dynamism is desirable.

Were there any land owner or legal requirements which needed consideration?

A large part of the new channel passes through Site of Special Scientific Interest (SSSI) hay meadow and rush pasture. RSPB and United Utilities worked with Natural England to put in place measures to protect the meadows. The channel follows old relict features where the vegetation is dominated by rush and coarse grasses. Contractors were only permitted to track along the course of the new channel; no soil was stored on the meadow but had to be transported over bog mats to a soil storage area off the meadow. As a result the SSSI meadow has suffered no damage and meadow management outside the SSSI will see the net amount of species-rich grassland increase over the medium term.

6. Funding

Funding summary for Working with Natural Processes (WWNP)/Natural Flood Management (NFM) measures	
Year project was undertaken/completed:	River restoration in 2016
How was the project funded:	Environment Agency (£70,000), Natural England (£52,500), United Utilities (£40,000), RSPB (£25,000), Cumbria Waste Management Environment Trust (£25,000)
Total cash cost of project (£):	£212,500
Overall cost and cost breakdown for WWNP/NFM measures (£):	Capital delivery cost (contractor): £205,000 Geomorphological clerk of works: £7,500 Project design, fish rescue: Environment Agency in-kind contribution Project management: RSPB in-kind contribution Monitoring: RSPB, Environment Agency, universities in-kind contribution Maintenance: not costed (anticipated to be minimal)
WWNP/NFM costs as a % of overall project costs:	Not applicable
Unit breakdown of costs for WWNP/NFM measures:	Not applicable
Cost–benefit ratio (and timescale in years over which it has been estimated):	Flood risk benefit has not yet been determined.

7. Wider benefits

What wider benefits has the project achieved?

The project at Swindale provides an opportunity to see to what extent measures that are undertaken to benefit wildlife and water quality can also play a role in reducing flood risk. It is expected that the works described will:

- contribute to improved raw water quality
- increase populations of woodland birds and other taxa associated with semi-natural broadleaved woodland in the region
- increase botanical richness of the river valley
- improve fish spawning habitat

How much habitat has been created, improved or restored?

- 1,140m restored dynamic meandering river system
- New native woodland planting
- 1,000ha peat bog restored

8. Maintenance, monitoring and adaptive management

Are maintenance activities planned?

It is anticipated that the natural river channel will require less active maintenance than the artificial channel it replaces.

The partners will respond to the findings of the current research to determine whether woodland management could be adapted to provide an improved flood risk management function. It is expected, however, that the value of native broadleaved woodland in slowing flows will be enhanced by the diverse and complex structure of the shrub and field layer, including standing and lying dead wood and dense bryophyte communities. Therefore significant management is not expected to be needed.

Pending the outcome of current feasibility work, new flood attenuation features will need monitoring to ensure they continue to perform to their design specification. This work will be incorporated into existing estate management plans.

Is the project being monitored?

See above for detail.

Stage loggers are being installed to complement existing flow monitoring. This will also allow real data to be used to test modelled predictions of the channel response.

The response of river fish and invertebrate communities and wider bird populations are also monitored.

Has adaptive management been needed?

Adaptive management was required during the construction of the new river channel to manage the risk associated with mobilising silts following heavy rain during construction.

9. Lessons learnt

What was learnt and how could it be applied elsewhere?

The most important lesson from the work at Haweswater and from the Swindale Valley Restoration Project in particular is that it is possible to manage land in such a way that downstream flood risk is reduced through approaches designed to deliver other benefits.

The cost of the work in the Swindale Velley cannot be justified on the basis of a predicted flood risk benefit alone, but when you factor in the long-term benefits to wildlife, water quality and recreation it begins to look like very good value for money.

There will be plenty of cases in Cumbria and elsewhere where NFM interventions will be cost beneficial for flood risk reduction alone. However, the approach could deliver much more if consideration is given to the full range of benefits a new approach to catchment management could deliver and a new land use policy framework is developed with that in mind.

10. Bibliography

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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.