

Case study 38. Eycott Hill

Author: Stephen Owen

Main driver: Habitat improvements

Project stage: Underway



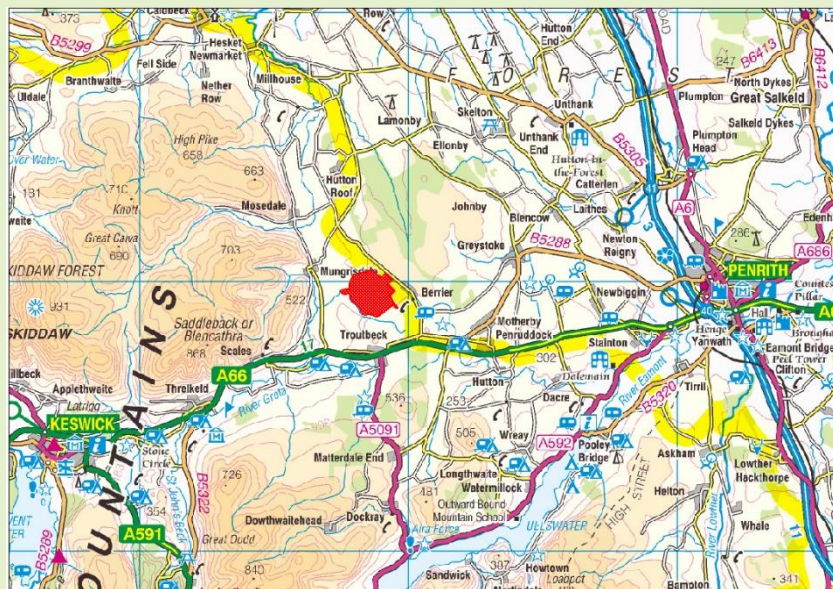
Photo 1: Eycott Hill Nature Reserve (source: [Cumbria Wildlife Trust](#))

Project summary:

Cumbria Wildlife Trust purchased the Eycott Hill Nature Reserve near Penrith (Photo 1 and Map 1) in April 2015. The reserve consists of important mire habitats, in amongst some less interesting areas of upland grassland. The aim of conservation management on the reserve is to create a more diverse mosaic of better quality upland habitats that will support a greater range of wildlife. This will result in a mixture of wetlands, mires, grasslands, woodlands, scrub and hay meadows along with a section of restored river. The grazing on the reserve has been changed from intensive sheep grazing to an extensive, all year round, low intensity system with hardy native breed cattle. After a relatively short time changes can already be seen in the vegetation, which has become much more complex in structure. Other conservation work has included extensive tree planting and the blocking of artificial drainage channels. In 2017, a section of canalised river will be restored. As well as the biodiversity benefits, the conservation management on the reserve should have wider environmental benefits including reducing flood risk and improving water and carbon storage.

Key facts:

Conservation management work at Eycott Hill will produce a more varied, complex mosaic of habitats that will be richer in wildlife, while slowing down and reducing the flow of water into part of the Derwent catchment. This catchment has suffered severe flooding in recent years and has several communities at risk including Keswick and Cockermouth.



Map 1: Location of Eycott Hill (marked in red)

1. Contact details

Contact details	
Name:	Stephen Owen
Lead organisation:	Cumbria Wildlife Trust
Partners:	Newton Rigg College
e-mail address:	stepheno@cumbriawildlifetrust.org.uk

2. Location and catchment description

Catchment summary	
National Grid Reference:	NY 386 295
Town, County, Country:	Keswick, Cumbria, UK
Regional Flood and Coastal Committee (RFCC) region:	North West
Catchment name(s) and size (km²):	Derwent, 1,235km ²
River name(s) and typology:	Naddles Beck
Water Framework Directive water body reference:	GB112075070490
Land use, soil type, geology, mean annual rainfall:	Conservation management, rough grazing Clay, Skiddaw slate, Eycott Volcanic Group rocks and limestone all feed into Naddles Beck Average annual rainfall: 1,584mm (at nearby Blencathra Field Centre)

3. Background summary of the catchment

Socioeconomic/historic context

Most of the run-off from the Eycott Hill Nature Reserve enters Naddles Beck. This flows into the Barrow Beck, then into the River Glenderamackin and later the River Greta. Eycott Hill has probably been to some extent settled and grazed from before the Roman invasion. Recent archaeological survey work by the Lake District National Park Authority has revealed various prehistoric structures. The name Eycott, probably comes from the Norse, 'Aiket' meaning oak wood, suggesting that some of the area was still forested in Viking times. At present the main land use around Naddles Beck is rough grazing and forestry. There was also previously peat cutting on some of the mires near the summit of Eycott Hill, as shown by maps from around 200 years ago of the allocations to different nearby farms.

Parts of Naddles Beck, like many watercourses in the Derwent catchment, have been straightened and modified in other ways in an attempt to get water off the land quicker. A number of drainage channels have also been dug along the western flanks of Eycott Hill in an attempt to drain the land. These feed into Naddles Beck.

Flood risk problem(s)

The Derwent catchment with its high rainfall, impermeable upland geology and waterlogged mountainous soils suffers high run-off and frequent floods. Downstream of Naddles Beck, Keswick and Cockermouth have suffered frequent flood issues, mostly due to overtopping of flood defences. Newspaper reports suggest that this has been occurring for at least every 250 years. There were particularly serious floods in Keswick in November 2009 with 240 properties affected and in December 2015 when 515 properties were flooded. The watercourses that most affect Keswick are the Greta and the Derwent rivers.

Focusing on Naddles Beck, rapid run-off into the beck from the surrounding land contributes to the flooding issues down river. In particular, as Naddles Beck has been moved and straightened, the poor state of the flood embankment on one side means there can be serious flooding of the fields immediately to the west of the beck. These fields are owned by Newton Rigg agricultural college.

Other environmental problems

Some parts of the Derwent catchment score poor or moderate for ecological condition according to the Environment Agency's River Basement Management Plan for the North West River Basin District (Environment Agency 2009a). This is generally due to poor scores for fish and other aquatic life, resulting from habitat issues such as water quality, abstraction and modifications to river morphology. In particular the subcatchment of which Naddles Beck is part – the Glenderamackin upstream of Troutbeck (GB112075070490) – has poor condition. Parts of Naddles Beck have been heavily modified and have a very simplified structure providing few different habitats. As such they are not conducive to supporting good fish populations.

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

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

Observations by Cumbria Wildlife Trust staff and neighbouring landowners identified that there are particular issues with flooding from Naddles Beck affecting neighbouring land to the west. The issues in general across the whole of the Derwent catchment have been assessed by the Environment Agency through various reports including the River Derwent Catchment Flood Management Plan (Environment Agency 2009b) and the River Basement Management Plan for the North West River Basin District (Environment Agency 2009a).

Advice from the Environment Agency on the restoration of Naddles Beck (Environment Agency 2014) and West Cumbria Rivers Trust suggested ways to improve Naddles Beck in terms of its morphology

and habitats. With particular relation to the work on Naddles Beck, the Cumbria Wildlife Trust will be working with hydrological consultants in early 2017 to model some of the current issues and how this work might change the beck. The flow data that will be used are not from Naddles Beck, but instead are extrapolated from Environment Agency flow data from further downstream on the River Glendermackin in Threlkeld.

The Eycott Hill conservation management plan (Cumbria Wildlife Trust 2014) identified a number of conservation management options across the nature reserve that would benefit Natural Flood Management (NFM) and water quality as well as improving habitats across the reserve. Much of this work has been supported through Higher Level Stewardship grants through Natural England. Natural England provided some advice as part of the process of choosing different HLS options.

What was the design rationale?

A number of conservation management options have been chosen (see Map 2) for the nature reserve which will have a positive impact on flood management as well as our wildlife conservation goals.

Project summary	
Area of catchment (km²) or length of river benefitting from the project:	216ha (2.16km ²) of the catchment will be affected by the project – effectively the size of the Eycott Hill Nature Reserve
Types of measures/interventions used (Working with Natural Processes and traditional):	<p>Restoration of upland valley mire complex – through blocking of artificial drainage channels</p> <p>Blocking of artificial drainage channels through grassland on western slopes of Eycott Hill</p> <p>Tree and scrub planting in various places around the nature reserve – over 7,500 planted so far, more planting to continue over next 2 years</p> <p>Change from intensive sheep grazing to extensive all year grazing with small number of cattle, producing rougher more complex vegetation cover</p> <p>Creation of wetland scrapes and pools</p> <p>Restoration of canalised section on Naddles Beck: this will include an element of traditional flood management through a flood embankment and Working with Natural Processes (WWNP) measures through encouraging remeandering of the beck.</p> <p>Encouraging restoration of heathland that will have thicker vegetation: this has partly been through changes to the grazing regime and more active interventions including additions of heather brash and seeds from another site and the planting of heathland plug plants</p>
Numbers of measures/interventions used (Working with Natural Processes and traditional):	7
Standard of protection for project as a whole:	Difficult to measure the effects of WWNP projects combined on the overall catchment, as accurate baseline flow data from before the project began are not available. Some of the WWNP measures will take time to properly develop.

	The level of protection for the repaired and enhanced embankment will be assessed by hydrological modelling in early 2017.
Estimated number of properties protected:	Difficult to quantify regarding properties, as they are a small part of the overall catchment. Scheme will directly affect the flooding on a 3.5ha field to the west of the reserve.

How effective has the project been?

This cannot be ascertained at this stage. Although some habitat improvements can already be observed, some of the interventions mentioned above will take time to develop. The ideal would be to install flow meters in Naddles Beck just downstream of the restoration area, but all the flow data prior to the project are extrapolated from elsewhere, it will be difficult to compare these properly with any recorded flows as the project develops.

5. Project construction

How were individual measures constructed?

Measures that have been completed or underway are listed in Table 1. Map 2 shows where these elements of the site's management are located.

Table 1: Summary of individual measures

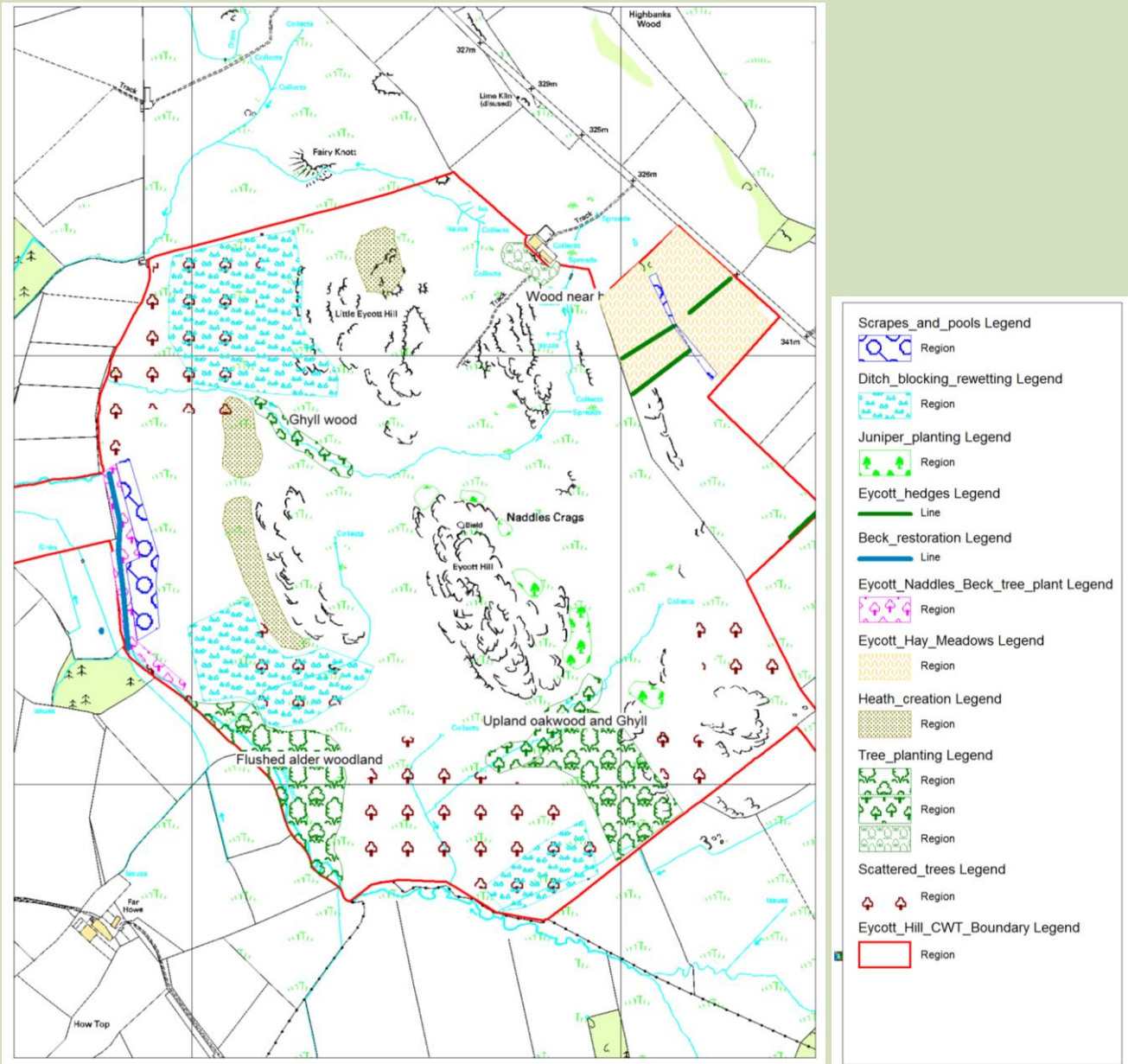
Measure	Delivery details
Grazing regime	A small herd of cattle has been introduced to graze the reserve. These cattle are owned and managed by Newton Rigg College. They are Luing cattle, a native hardy breed that can be left out on the site all year and do well on such rough ground. Already the change from a much larger number of sheep has resulted in a rougher, more structurally complex vegetation developing.
Tree planting	So far this has taken place in 3 main blocks, including alongside Naddles Beck, along a ghyll (or gully) and an upland oak woodland area. The trees have been guarded and fenced to protect them. There are also scattered trees and juniper scrub planted in pockets elsewhere across the reserve.
Mire restoration	The small valley mires located on the higher parts of the reserve have had artificial drainage channels dug into them. These were blocked, helping to store water in these features.
Heathland restoration	Patches of ling heather and bilberry have started to re-appear elsewhere with the change in grazing. Along a section on the western slopes a more active approach has been adopted. In winter 2015, contractors scraped patches of turf to create bare earth and then spread heather brash. There has been some germination of ling heather plants, but not as much as expected. There will therefore be more re-seeding and plug planting of heathland plants in early 2017.
Ditch blocking	A number of drainage ditches had been dug into the western and southern slopes of Eycott Hill to attempt to improve this area for agriculture. These have been mapped and prioritised for ditch blocking. The first phase in the winter of 2015 to 2016 blocked ~1,500m of ditches. The work was carried out by tracked mini diggers, with earth and turf dams created at set intervals along the ditches. A further 2,700m of ditches will be blocked in 2017.

Wetland scrapes and pools

These will be created by mini diggers and will be of varied depth and shape.

Naddles Beck restoration works

Part of the beck has been moved so that it sits above its natural floodplain, canalised and repeatedly dredged. Spoil from one of the nearby scrape creation areas will be used to restore and extend a flood embankment that runs fairly close the west side of the beck. This will prevent much of the flooding into the silage field adjacent to the west. An Environment Agency report advising on potential restoration (Environment Agency 2014) suggested that keeping more water within the beck during high water events will allow natural processes such as remeandering to take place. This will be further encouraged by the introduction of some larger rocks in strategic places along the beck.



Map 2: Eycott Hill Nature Reserve site plan (source: Cumbria Wildlife Trust)

How long were measures designed to last?

See Table 2.

Table 2: Design life of measures

Measure	Time
Grazing regime	Indefinitely
Tree planting	Indefinitely
Heath restoration	Indefinitely
Ditch blocking	Indefinitely
Scrapes and pools	~20 years (will silt up with time, potential consideration of creating more scrapes and pools to allow the process to begin again)
Mire restoration	Indefinitely
Naddles beck restoration work	The embankment may need repairs after 10–20 years. If this is done, it is intended that the remeandering and restoration of natural fluvial processes will be indefinite.

Were there any landowner or legal requirements which needed consideration?

There are a number of legal requirements and other considerations:

- Half of the reserve is a Site of Special Scientific Interest (SSSI), so any activities in these areas require Natural England consent.
- Flood drainage consent will be sought for the Naddles Beck work (primarily for the introduction of temporary crossings during the works and the reintroduction of large rocks in the beck). This will also include carrying out a Water Framework Directive assessment.
- Planning permission is required for the Naddles Beck embankment and 2 scrape areas. The former also requires a flood risk assessment.
- Discussions have been held with neighbouring landowners and project partners Newton Rigg regarding the Naddles Beck work.

6. Funding

Funding summary for Working with Natural Processes (WWNP)/Natural Flood Management (NFM) measures	
Year project was undertaken/completed:	2014 onwards Funded work started at Eycott (3 main funding streams started at different points)
How was the project funded:	Higher Level Stewardship WREN Heritage Lottery Fund
Total cash cost of project (£):	Above elements cost £111,722 as part of overall Eycott Hill project
Overall cost and cost breakdown for WWNP/NFM measures (£):	No final costs for all elements of the project. The budgeted amounts are as follows: Woodland plantings: £36,300 Heathland restoration £12,000

	Scrape creation: £10,800 Naddles Beck restoration: £34,800 Ditch blocking: £11,628 Tree and wildflower planting as part of Naddles Beck project: £6,174
WWNP/NFM costs as a % of overall project costs:	14% of the overall Eycott Hill project budget (which includes staff times and a large number of other projects)
Unit breakdown of costs for WWNP/NFM measures:	Estimated unit costs are as follows (the final project costs may be different): Woodland plantings: £2,312 per hectare Heathland restoration: £2,353 per hectare Scrape creation: £8.64 per m ² Naddles Beck restoration: £87 per metre Ditch blocking: £2.76 per metre
Cost–benefit ratio (and timescale in years over which it ratio has been estimated):	Not calculated for this project

7. Wider benefits

What wider benefits has the project achieved?

Beyond NFM, the project at Eycott Hill Nature Reserve will provide considerable benefits for wildlife through the creation of a more complex mosaic of different habitats. Some of the developments such as woodland plantings, grazing changes and ditch blocking should reduce soil erosion and thus improve water quality. The restored mires and newly developing woodlands will also act as carbon stores. Finally, the wider variety of improved habitats, combined with access and interpretation works, will make Eycott Hill Nature Reserve a more interesting and attractive visitor destination.

How much habitat has been created, improved or restored?

Table 3 details the area of different habitat that have either been created or improved.

Table 3: Created or improved habitats

Habitat	Area created or improved
Valley mires	~12ha restored/protected from drainage
Upland acid grassland	~130ha in process of being improved structurally through grazing regime.
Wet grassland	~18.7ha in process of being improved through grazing regime and ditch blocking. Expect a total of ~4,200m of ditch to be blocked.
Heather moorland	~5.1ha in process of active restoration. In addition numerous other patches are developing in amongst the upland acid grassland.
Woodland	~15.7ha has been planted (upland oak wood, wet woodland, ghyll woodland and juniper scrub), along with scattered trees elsewhere
Wetland pools	~1,250m ² to be created in 2017
River	400m of Naddles Beck to be restored in 2017

This is likely to also have a positive influence on another 500m immediately downstream.

8. Maintenance, monitoring and adaptive management

Are maintenance activities planned?

Maintenance has been planned and is already being undertaken when necessary by Cumbria Wildlife Trust staff and volunteers.

Is the project being monitored?

A comprehensive monitoring scheme was developed in 2016 to monitor vegetation change across the reserve in response to the new grazing regime. There has also been specific monitoring of the new woodland plantings and the active heathland restoration work. The mires are monitored by Natural England as one of the site's SSSI features.

Once the Naddles Beck restoration and scrape creation work is completed, these will be monitored by fixed point photography.

Has adaptive management been needed?

To date, most measures have been delivered with reasonable success.

The main exception is the more active heathland restoration works. Monitoring work in the summer of 2016 revealed that there had not been a great germination of new heath plants from this. The bare earth that had been created is rapidly becoming revegetated. With this in mind, more seed sowing and heathland plug planting is planned for the early 2017 to capitalise on the bare earth that remains.

Some of the ditch blocking has not been as successful at holding water back as had been hoped. As a result the design may be slightly changed for some topographic situations for the second phase of ditch blocking in early 2017.

Vegetation monitoring may result in changes to grazing regime with time. There may also be some changes made to Naddles Beck restoration work (for example, to the embankment) following observations over subsequent winters.

9. Lessons learnt

What was learnt and how could it be applied elsewhere?

Much of the work has either only recently been carried out or has not been started. Observations and monitoring over the following years should indicate how these measures are performing and how they could be improved.

Lessons are already being learnt in 2 main areas.

- With the heathland restoration work, the lack of success using heather brush. The project team hope to more success and will be able to learn from using seed trampled into the ground and plug plants.
- The blocking of artificial drainage channels using earth and turf dams does not always work depending on the topography. In particular, it appears that if the channel is fairly steep and sits within a wider depression than just the drain channel itself, the water will work its way around the dam reasonably easily. For the next stage of ditch blocking in early 2017, changing the design will be considered, possibly using a short channel coming out laterally from the dam to spread the water out on to the land to the side.

Perhaps the most important lesson has been to highlight how good conservation land management, especially when it works alongside natural processes, can also deliver NFM.

10. Bibliography

CUMBRIA WILDLIFE TRUST, 2014. *Eycott Hill Conservation Management Plan*. Kendal: Cumbria Wildlife Trust.

ENVIRONMENT AGENCY, 2014. *Naddles Becks restoration design*. Technical note. Penrith: Environment Agency.

ENVIRONMENT AGENCY, 2009. *River Basin Management Plan for the North West River Basin District*. Bristol: Environment Agency.

ENVIRONMENT AGENCY, 2009. *River Derwent Catchment Flood Management Plan*. Bristol: Environment Agency.

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](#).