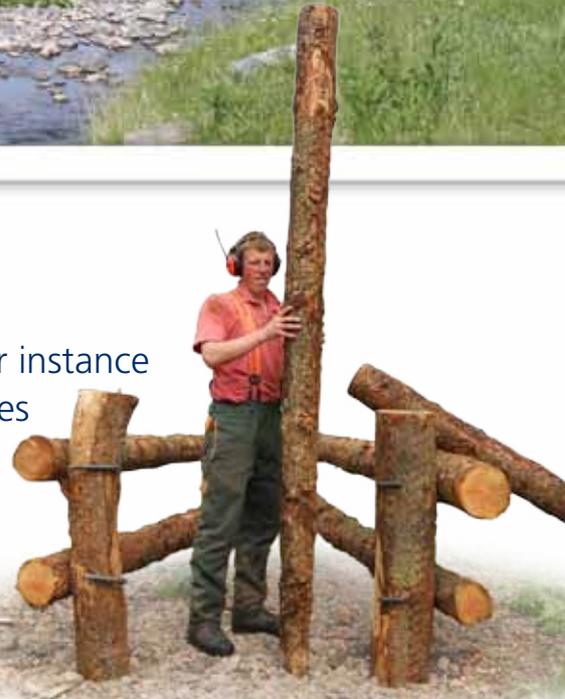


Engineered Log Jams

Engineered Log Jams (ELJs) can be utilised in many ways, for instance as bank protection and erosion stabilisation, and as structures to encourage sediment deposition within the river channel and on the floodplain.

Cheviot Futures has been fundamental in completing a series of demonstration sites to showcase the variety of ELJs – the first of its kind on a catchment scale. The sites are within the Bowmont Valley and complement the wider approach to Natural Flood Management (NFM) used there.



Bank Protection ELJ

Bank Protection ELJ works have now been completed on three farm sites within the Bowmont Valley (Clifton-on-Bowmont, Swindon Haugh and Kelsocleuch) with variations on design and specification at each site to allow comparisons to be made and lessons learnt with regard to effectiveness. ELJs used for bank protection can be part of a whole farm approach to riverbank erosion stabilisation, as demonstrated at Clifton-on-Bowmont.



Work underway to install vertical piled timbers as bank protection, Clifton-on-Bowmont, September 2011.



Completed bank protection ELJ works at Kelsocleuch, June 2012.



Completed bank protection ELJ works at Clifton-on-Bowmont, October 2011.

Some sites fared better than others during the large flood event of September 2012 – see article overleaf.

Bar Apex ELJ

Bar Apex ELJ features are designed to replicate the action of fallen timber within a floodplain situation, slowing down the rate of flood water flow and encouraging the deposition of suspended sediments. It is hoped that the introduction of such structures may have a role to play in the sustainable management of sediment transfer within dynamic upland river systems such as the Bowmont.

A total of 45 structures have been erected across three farm holdings (Clifton, Swindon Haugh, Kelsocleuch) and comprise a triangular structure built from vertical and horizontal timbers. Native trees have been introduced to the structures in order to provide longevity to the features – once the timbers have rotted away, the trees will hopefully be established and strong enough to continue the flow diffusion and sediment trapping function, whether as upright growing trees, or as fallen timbers in time.

Contractor Rupert Haywood (Haywood Contracting Ltd) demonstrating the length of timber used in the construction of bar apex ELJ features at Clifton-on-Bowmont, June 2012.



One of the bar apex ELJ features in action on the Swindon Haugh site, demonstrating the capture of sediment material and slowing of flood water flows, September 2012.



Bar Apex ELJ feature at Kelsocleuch, one of 12 constructed at this site, showing final element of specification – native tree planting within each feature.

Grade Control ELJ

Grade Control ELJ features are intended to assist the repair and natural stabilisation of incised erosion within watercourses. A grade control structure has been completed in the headwaters of the Bowmont in order to regenerate a section of the Kelsocleugh Burn, which has been incised by water dropping from height from a piped bridge structure.



Completed grade control feature on the Kelsocleugh Burn, in the headwaters of the Bowmont catchment, June 2012.



The completed grade control ELJ on the Kelsocleugh Burn, June 2012.

Flooding Assessment: *Lessons learned from September 2012 Flood Event*

One of the key impacts of predicted climate change is an increase in severe weather events, with an associated risk of exacerbated flooding and erosion issues.

In September 2012, the flood resilience projects undertaken to date by Cheviot Futures, including the Engineered Log Jam sites, met their biggest test with a large flood event affecting all sites.

Some sites fared better than others, but all offered some lessons to be learned and experience to be gained. The value of Cheviot Futures demonstration works lies in the acceptance that some work will prove to be less viable than alternative options, and the process of determining what works and what does not.

At **Clifton-on-Bowmont** the bank protection ELJ survived intact, as did the newly constructed bar apex ELJ features (although one is now within the Bowmont Water due to channel change!). The willow spiling work and the Filtrexx bank stabilisation both suffered minor damage to the downstream extent, highlighting the need for effective fixation to stable ground and consideration of the effects on flow to features such as mature trees. The timber palisade revetment site suffered significant damage for the second time (a section was removed in May 2012 and additional work carried out by the farm business to reinstate and extend the work), suggesting that this approach was not the most appropriate for the site.

At **Swindon Haugh** the newly completed bank protection works, utilising a variation on the ELJ approach was removed in its entirety by the high flows. This has been put down to the requirement to alter the specification during works to take account of the concrete-like nature of the eroded bank face, which prevented vertical timbers being driven backwards into the bank itself. This evidences that a series of logjams as bank protection needs to be secured into the bank itself, as per the original specification.

Of the 21 bar apex logjam features erected, two were lost in the flood event and a further two suffered damage. The remaining features have provided valuable early evidence of their actual behaviour, to compare to the theoretical concept.

At **Venchen** the floodplain specification fencing work demonstrated its value. Approximately 50m of fence suffered minor damage during the flood event, but was re-erected at minimal repair cost within a matter of days. The fence broke close to an intended break point, meaning that a distinct section lay flat once waters receded, without significant

negative impact on the rest of the fence-line. It would be worth installing an additional break-point at this location in future, should this prove to be a regular vulnerable point. This is something which can only be fully determined following flood events and by working closely with the landowner.

At **Kelsocleugh** the recently completed logjam works fared reasonably well, reflecting their headwater location and resultant comparative reduced vulnerability. The bar apex logjams all survived intact, as did the structure of both the bank protection and grade control logjam, although some additional erosion of the banks at the grade control site, and some of the backfill material from the bank protection site was evident. We are reasonably confident in our conclusion that the latter was largely due to the flood event occurring so soon after works were completed (approx. 5 weeks), meaning that backfill had insufficient time to settle and consolidate.

At **Elilaw** the flood event was in advance of the final element of works being completed on site. However, there was evidence that the farm pond feature did fill in excess of its regular fill level, with excess water slowly discharging to the watercourse following the main flood peak. Flood, water also spilled from the ditch bund to the floodplain storage area. There were still issues of water running down the road in the village of Netherton downstream, partly attributable to debris blocking the culvert feature. It is hoped that the fully completed scheme of works will assist in holding additional flow back in future events, maximising the potential for this feature to cope with high flows. Since completing this project additional funding has been secured for the catchment through Northumberland County Council and the Environment Agency. Cheviot Futures will continue to be a key project partner in this work going forward.

At **Kirknewton** the bank protection works based on a vertical timber palisade concept was only in place for approximately 4 weeks in advance of the large flood event at the end of September. Of the 200m completed, approximately 30m was removed by the action of the water, with flow undermining some of the timbers. This offers valuable lessons in terms of the suitability of this approach and whilst some damage was sustained, it is considered that the timbers did offer some protection to the flood bank behind. The work has now been superseded by sediment management efforts on the site, undertaken by Northumberland County Council in relation to the West Newton Bridge structure.

Cheviot Futures has been fundamental in completing a series of demonstration sites to showcase ELJs on a catchment scale and further Natural Flood Management (NFM) techniques. Learning and knowledge sharing is a vital part of Cheviot Futures, the aim of this case study has been to share the learning and practicalities of implementing these innovative techniques.