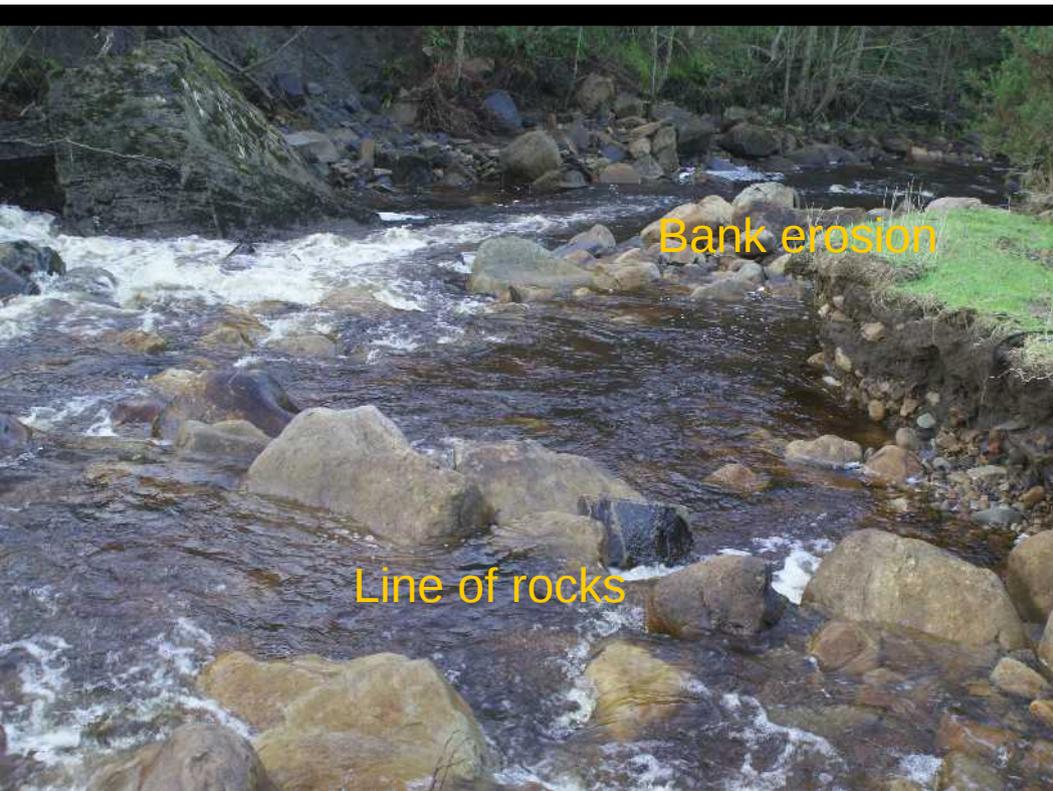


In River Training - Dr Rod Everett, Farmer Backsbottom Farm, Roeburndale Lancaster working on restoring River Roeburn in conjunction with the Lune Rivers Trust - www.riverroeburn.uk.

The rocks give the river an impulse to change its course very effectively at a low cost.

Observation

During Flood Desmond the river Roeburn eroded the banks near the ford and increased the width of the river by 30%. Two lines of rocks that came out from the bank and led downstream as they went towards the middle of the river, started the erosion.



A photographic survey of the River Lune erosion showed extensive erosion around rock groins that came out from the bank with a downstream shape. Where banks had been 'protected' with rocks, the extreme force of flood Desmond storm water has jetted through the rock gaps and eroded large areas of field behind them. It was estimated that at least 1 million Cu M of soil had been eroded along the Lune by these features.

R.D.Everett 2016 The erosive effect of hard groins seen on the River Lune and River Kent.



Groins downstream shape



Rock bank protection



In other places rocks coming out from the bank and leading upstream protected the bank and these sometimes collected stones and rocks along the bank.



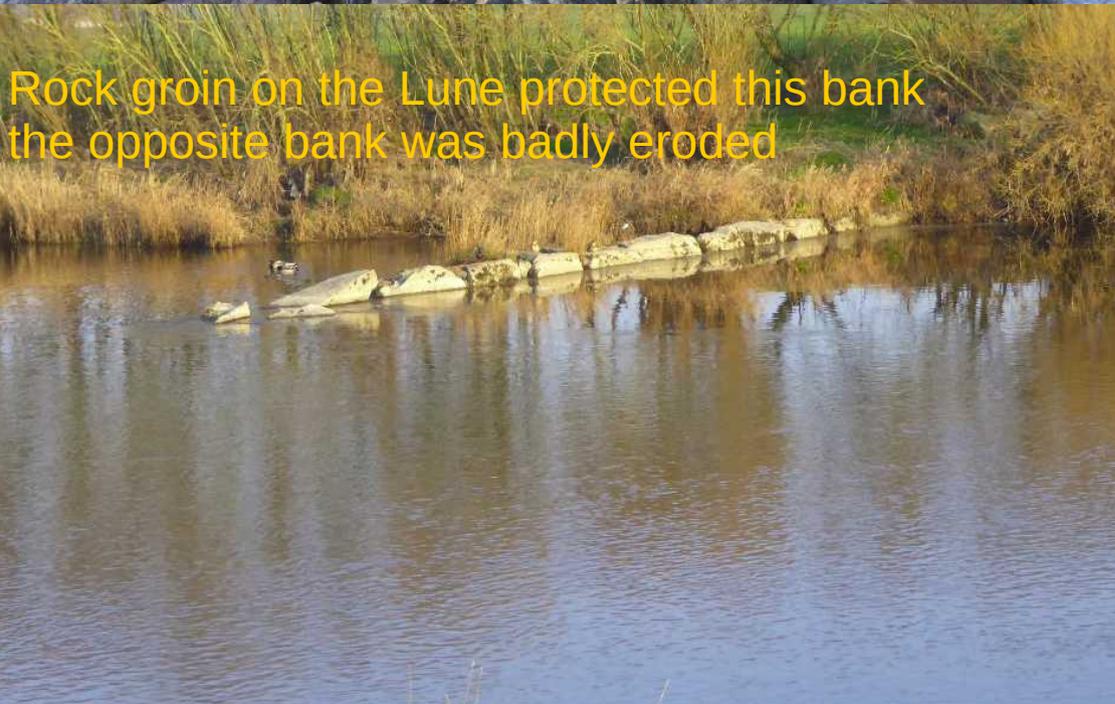
Timber debris collected

Rocks collected



A few rocks on River Kent

Gravel collected



Rock groin on the Lune protected this bank the opposite bank was badly eroded



The original rocks

3 Rocks on Roeburn collected these stones during flood Desmond

Inspiration

These observations led to further literature research and particularly the work Otman Grober in Austria who created funnels of rocks to speed up and deeper rivers to help his river restoration work.

Victor Schauberger who had a deep understanding of water flows and movement. More recently Christine Sindelar in Austria who works with rock vanes to protect banks.

Bill Zeedyk and Van Clothier in USA who use rocks and timber pickets To create induced meandering. Their book Let Water Do the Work 2009.



Experimenting

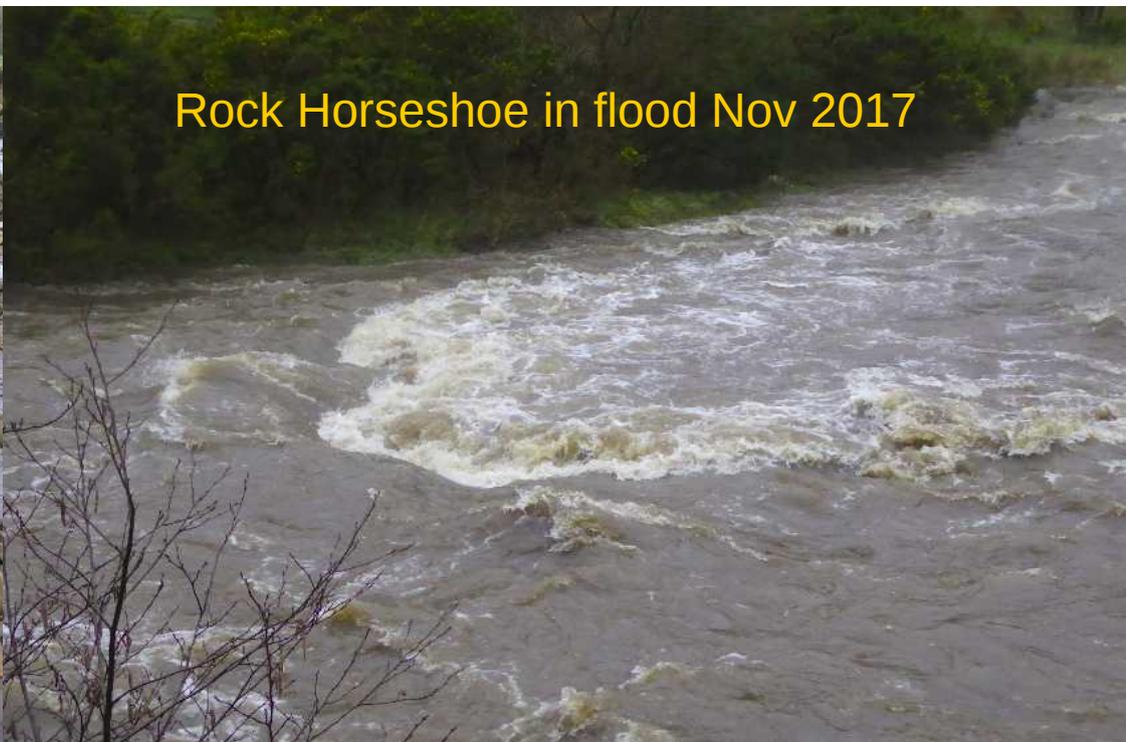
After flood Desmond a small stream with soft clay base developed on a landslip. This was used to explore how stones and small pieces of wood placed in different positions would alter the stream flow. (Working with River flow - <https://youtu.be/1mtTTJfCfIY>)



Rock Horseshoe 2016



Rock Horseshoe in flood Nov 2017



Rock horseshoe after 16th March 2019 flood



Channel 30cm deeper and part of the main flow pulled over to this side of the river

This horse shoe shape has been very effective at giving the water flow an impulse to move towards the opposite side of the river and prevent bank erosion. Over the last 3 floods I would have expected the river to overflow its banks but this was avoided.

The vanes C and D collected rocks during every large flood event and some timber debris. The size of the gap between the rocks seems to determine the rock size collected. It feels as though a rock gap around 22cm would be best for this fast spate rocky river. One of the rocks in vane B has moved making it less effective. It appears that a good angle to the bank is around 30 degrees.



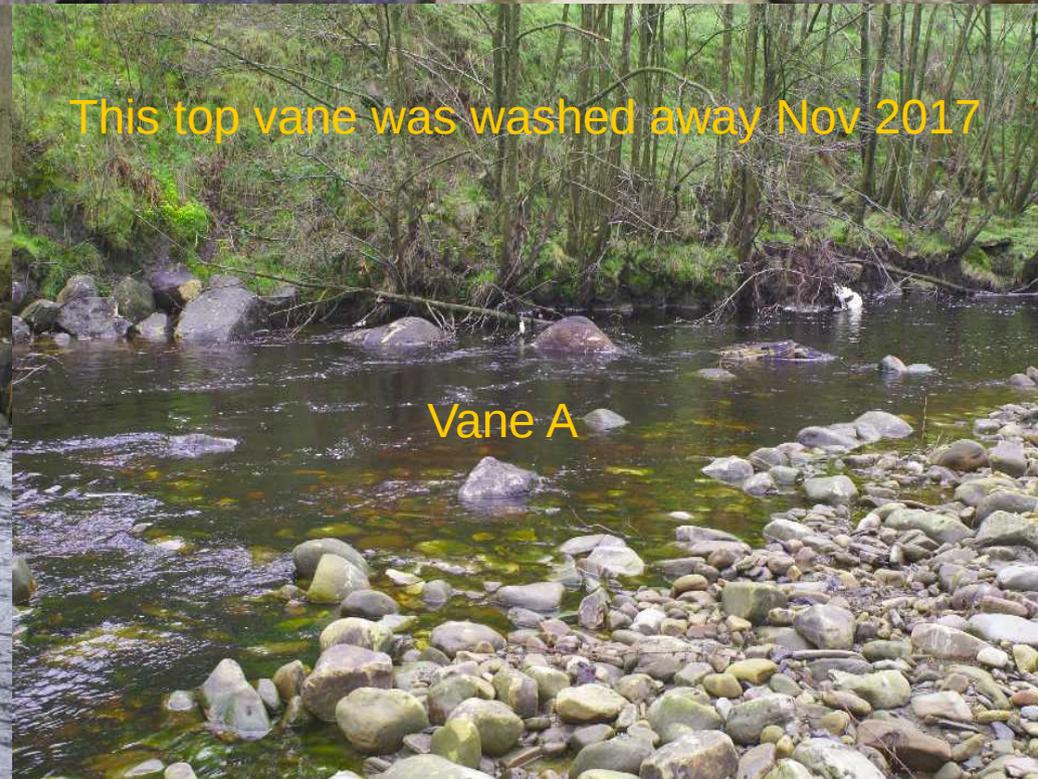
Vane C April 2019 collected rocks along bank



Vane D

Vane C

Vane B 2016



This top vane was washed away Nov 2017

Vane A



Vane D after construction 2016



Vane D April 2019 showing the build up of rocks along the bank

Conclusion.

In River Training with rocks has been successful in protecting the banks from erosion. Great care needs to be taken to toe in large rocks so that they don't move in large flood events. Some of these rocks that moved are over 1 ton. Maintenance is important. The angle of rocks to the bank is important. The larger the angle the more force the water has when it jets through them. The distance between the rocks effects the stone size collected. It feels that the water can change direction quickly but the rocks cannot, so they get trapped. The rocks were only collected in storm events.

For further work see www.riverroeburn.uk

Rod Everett April 2019 Royal Hydrological Society poster presentation.