



# ENHANCING STRAIGHTENED RIVER CHANNELS

## 3.5 Narrowing of an over-widened channel using low cost groynes

### RIVER AVON

LOCATION - Stratford-Sub-Castle, Salisbury, Wiltshire

SU 127327

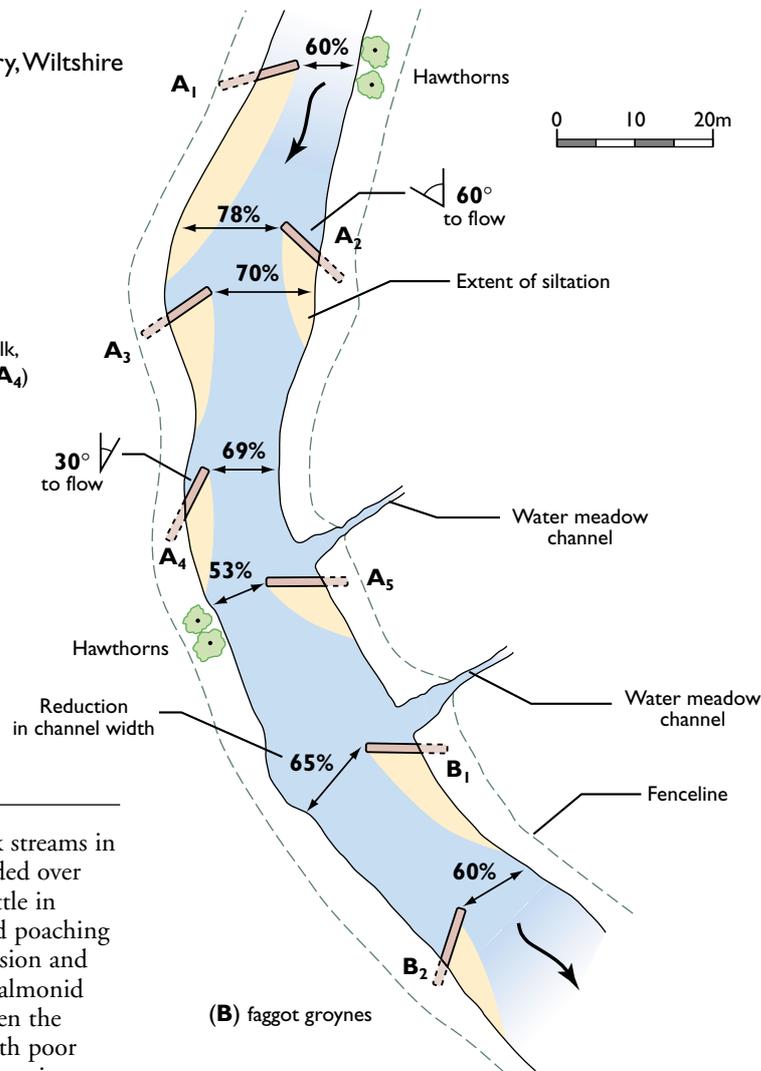
DATE OF CONSTRUCTION - October 1997

LENGTH - 125m

COST - £2000 (excluding fencing)

(A) groynes comprising chalk, all 60° (except A<sub>4</sub>)

**Figure 3.5.1**  
PLAN OF NARROWING WORKS



### DESCRIPTION

The Wiltshire Avon, like many other chalk streams in Southern England has been severely degraded over the past few decades. Excessive stock of cattle in adjacent fields have led to overgrazing and poaching of its banks resulting in extensive bank erosion and the accretion of sediment in downstream salmonid spawning gravels. The overall result has been the creation of a shallow over-wide channel with poor habitat diversity. This site was chosen because it represents a severely degraded chalk stream.

Recent habitat enhancement techniques on chalk streams have concentrated on modifying, and frequently narrowing, the channel to sustain increased flow velocities. These have involved bio-engineering methods such as the extensive use of willow, loose brushwood and faggots to redefine specific channel characteristics. However, these techniques have proven to be costly, in the order of £30- £55 per metre of river (see 3.1 and 3.2). This project sought to evaluate an alternative technique to establish whether the same level of habitat diversity could be achieved using low-cost groynes comprised of different materials.

Different types of groyne construction were trialed. The expectation was that the groynes would

‘re-energise’ the reach, providing variations in flow characteristics. Sediment being transported downstream would accumulate both upstream and downstream of the groyne and ultimately result in a ‘natural’ narrowing of the channel due to the settlement and accretion of transported material. Fencing of the river, preventing stock access would allow marginal plants to stabilise this new channel edge and lead to the creation of in-channel sinuosity and flow variation. Habitat diversity would follow as a direct consequence of the physical alterations and stock exclusion.

The total cost of the groynes was less than £2000, equating to a cost over the area of £11 per linear metre.

ENHANCING STRAIGHTENED RIVER CHANNELS

3



Completed chalk groynes

DESIGN

The design concept incorporated the need to diversify the flow characteristics along the length of the river by installing upstream facing groynes at specific sites on the right and left bank. These were placed according to the on-site observations and an understanding of the flow dynamics of the river.

Construction of the first of the 7 groynes in the 125m stretch commenced at the upstream limit of the site. The angle of groyne at the bank was decided by ascertaining the direction of flow (using a floating

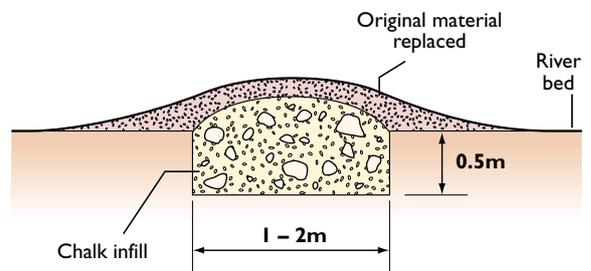
rope) and constructing at either 60° or 30° to this. The same method was used to construct each of the groynes. Final placement of the groynes was decided on site.

After marking out the area with pegs a JCB dug a trench 0.5m deep and 1-2m wide, with the excavated bed and bank material placed to one side. The trench was cut into the existing bank to anchor the completed groyne. The trench was then filled with either chalk or faggot bundles to provide reinforcement and stability and the excavated material from the original trench replaced on top.



Digging the groyne trench

**Figure 3.5.2**  
SECTION THROUGH CHALK GROyne

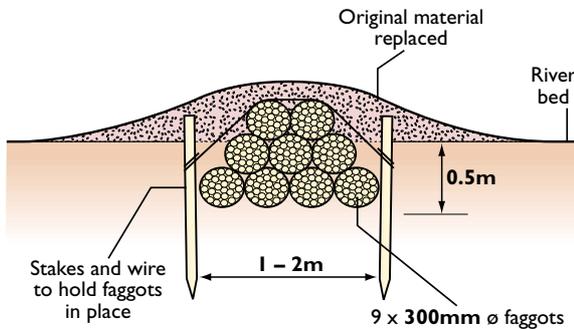




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**Figure 3.5.3**  
SECTION THROUGH FAGGOT GROYPNE



During construction of the chalk groynes the chalk was rammed down with the JCB bucket. For the faggot groynes the stakes were hammered in by hand, and the JCB bucket was used to hold down the faggots whilst they were wired in place.

By progressing downstream it became apparent that each structure produced a visible 'silt line' marking the extent of slack water created by the groyne. This information was used to determine the positioning of the next groyne, to maximise the likely benefit accrued from each by avoiding overlap.

The finished groynes slope from the bank towards the channel centre so as not to encourage turbulence and erosion of the bank. Also the groynes were positioned facing upstream to ensure that the high flows passing over them were angled towards the centre of the river. This is an effective 'bank protection' and 'pool scouring' measure.

### SUBSEQUENT PERFORMANCE 1997 – 2001

In narrowing the channel to approximately 60% the groynes have effectively increased velocities. Several structures have had some of the gravel surface eroded by winter flow, the material being deposited immediately downstream of the groyne forming shallow gravel riffles. The ends of the structures are areas of relatively high velocity: these areas have been utilised to great effect by both salmon and trout for spawning.

The desired accretion of material up and downstream of the groynes began soon after installation was completed. Particle sizes indicate a good mix of fine silt and organic material to coarse sand and gravel. This habitat has been colonised by a variety of submerged and emergent vegetation and is providing excellent habitat for lamprey and cyprinid fish fry.

An initial concern, visual intrusion of the groynes, has been negated by the rapid siltation and colonisation by marginal plants naturalising the structures and stabilising the banks. There was no significant difference in the performance and stability of the chalk filled groyne compared with the faggot filled structures: the chalk groynes were however 37% cheaper to construct.

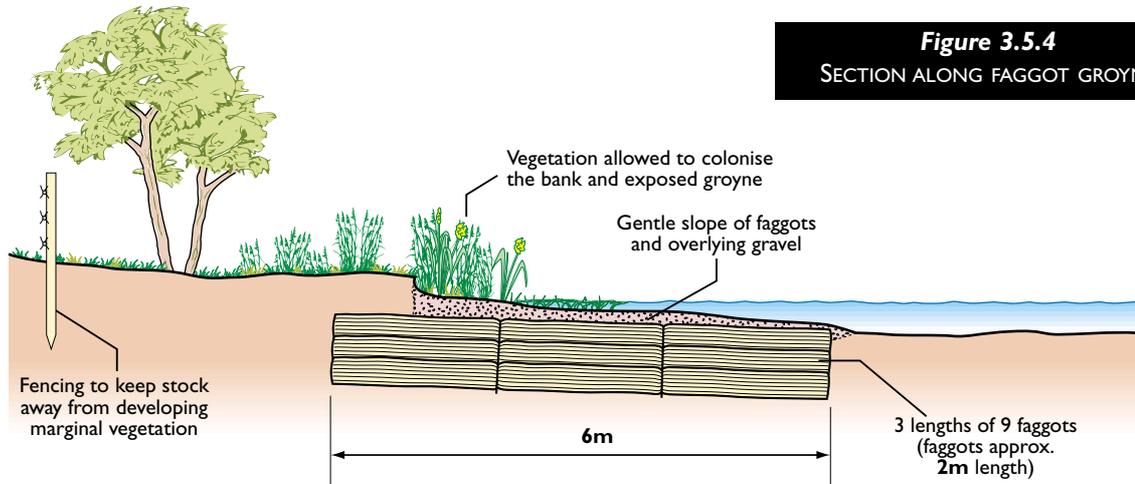
Pre and post-works monitoring was carried out to evaluate the success of the technique. Though the works budget was small it was felt that monitoring was sufficiently important to justify additional expenditure. Monitoring consisted of pre-works, 1 and 3 year post-works survey data on physical habitat and flow, fish population, macrophyte observations and macro-invertebrate community sampling.



Six months of siltation

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**Figure 3.5.4**  
SECTION ALONG FAGGOT GROYNES



Cattle poached, wide and shallow

Results from this work indicated that the groynes in combination with the fencing increased marginal emergent and submerged macrophyte diversity, a change in substratum composition (a shift from silt and sand domination to gravel and pebbles), with the finer material being deposited in the slackwater areas. Macro-invertebrate diversity was not influenced by the rehabilitation work, and fish population density and diversity improved.

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Groynes in place already increasing flow diversity



Silt deposits were quickly colonised and the river narrowed

