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Enhancing Straightened River Channels

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

RIVER AVON

LOCATION - STRATFORD-SUB-CASTLE, SALISBURY, WILTSHIRE SU127327

DATE OF CONSTRUCTION - OCTOBER 1997

LENGTH - 125M

COST - £2,000 (EXCLUDING FENCING)

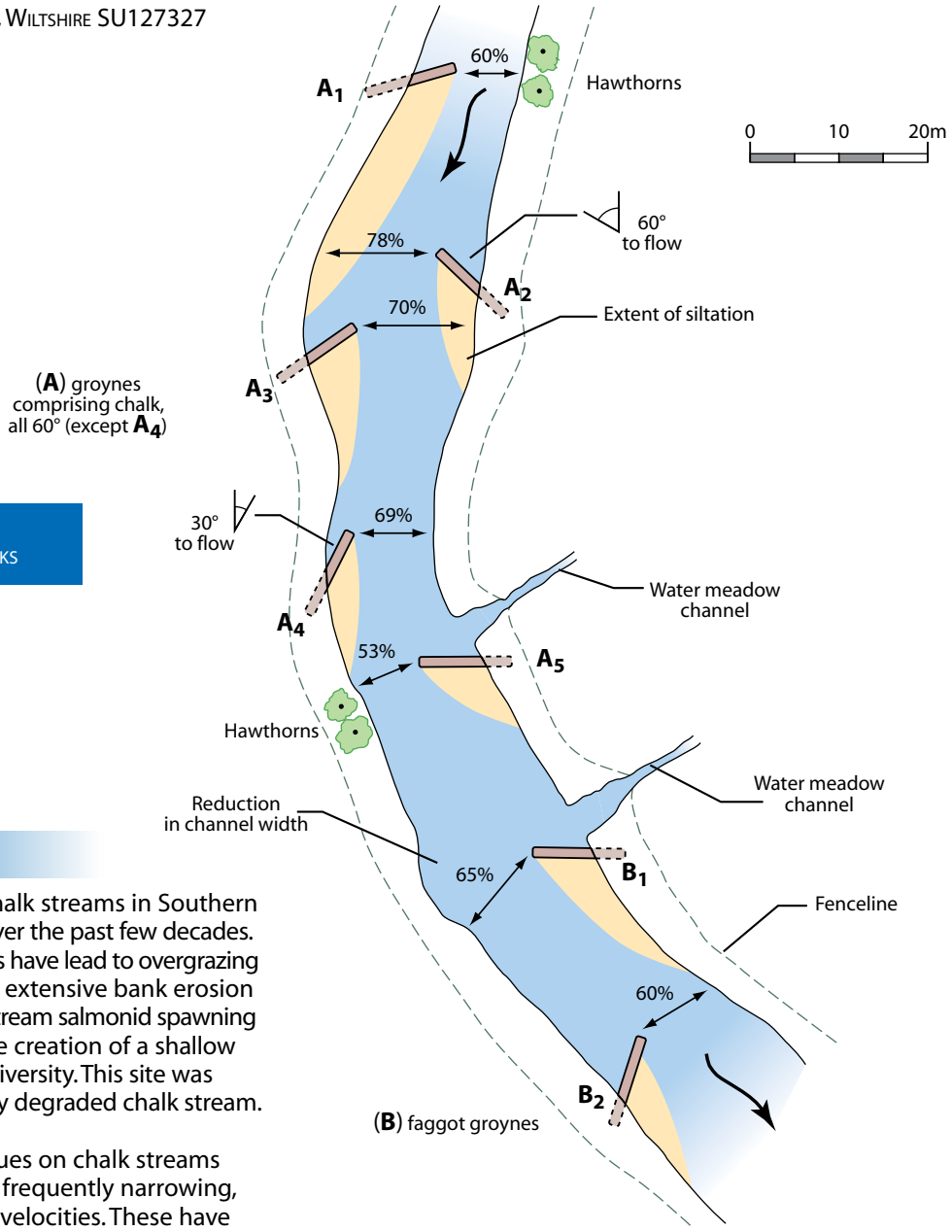

Figure 3.5.1
PLAN OF NARROWING WORKS

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 lead 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 (*Salix spp.*), 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 Techniques 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.

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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 seven 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.

Type **A** deflector – vegetation established

Figure 3.5.2
SECTION THROUGH CHALK GROYNE

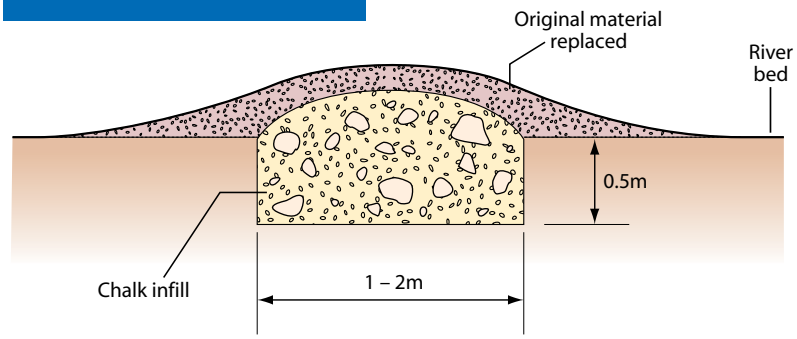

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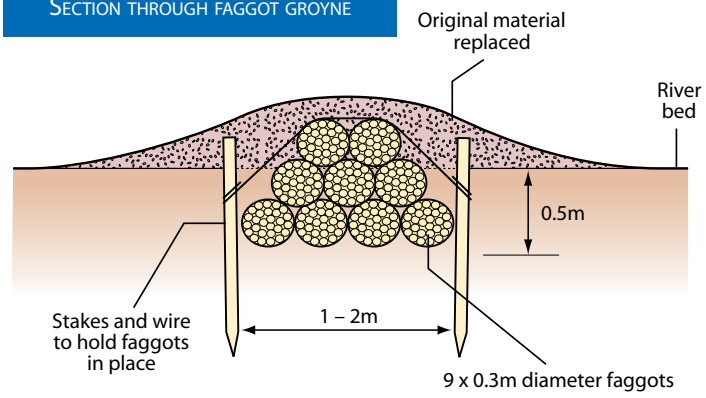
Figure 3.5.3
SECTION THROUGH FAGGOT GROYNE



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 Atlantic salmon (*Salmo salar*) and brown trout (*Salmo trutta*) 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, one and three year post-works survey data on physical habitat and flow, fish population, macrophyte observations and macroinvertebrate community sampling.

Type **B** deflector before planting

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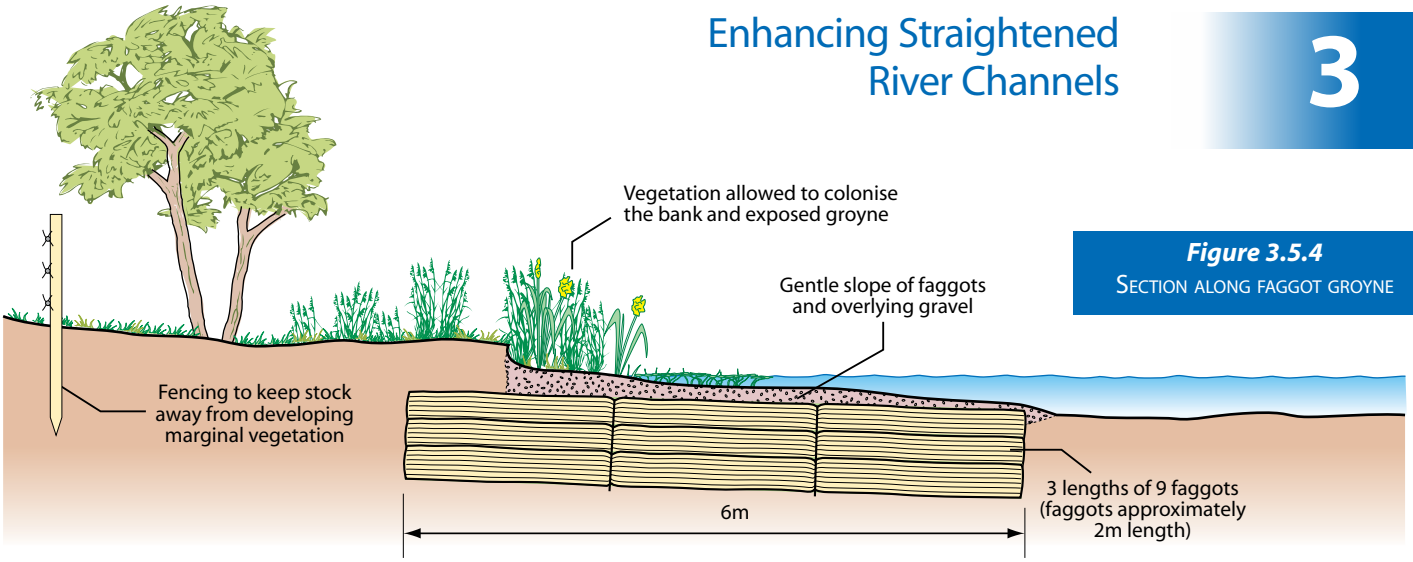

Figure 3.5.4
SECTION ALONG FAGGOT GROYNE

Cattle poached, wide and shallow

Groynes in place already increasing flow diversity

Silt deposits were quickly colonised and the river narrowed

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. Macroinvertebrate diversity was not influenced by the rehabilitation work, and fish population density and diversity improved.

Original Information Providers:
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3.5 River Avon 2013 Update

River Avon	Low energy, chalk
WFD Mitigation measure	**Click Here** to view details
Waterbody ID	GB108043022350
Designation	SAC, SSSI
Project specific monitoring	Vegetation, Fish, Morphology

Initially the chalk and faggot groynes were equally effective. In the medium to longer term the faggot groynes were less effective, disintegrating over time. The chalk groynes remained in place enabling material to accrete up and downstream. In addition the velocities created at the in-stream end of the chalk groynes have been important for attracting salmonids to spawn in the areas just downstream.

The use of faggots was a trial element of scheme but, as they were more costly and less effective in the long term, they would not be recommended for use in future projects of this nature.

Detailed surveys were carried out before the works were undertaken and a long term survey (due to be completed in 2013) has been carried out post works outlining changes to the morphology, hydrology and ecology of the reach. The plant community has changed markedly from pre-restoration and the study aims to determine whether the community has reached a climax structure or is still changing.

Following the works rapid siltation occurred, resulting in channel narrowing. In the 2007 survey an approximately 30% reduction in channel width was observed compared to pre works. The variations in flow characteristics observed in 2002 remain the same.

Catch monitoring undertaken by Salisbury District Angling Club (SDAC) indicates further increases in salmonids and spawning. Fished by wading, the site is a valuable fishery with good stocks of brown trout and grayling (*Thymallus thymallus*).

Most of the reach was fenced to prohibit the entry of cattle into the channel. In addition, there has been the occasional need to trim back willows along the walkways to maintain access for anglers.

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The narrowed channel – May 2007
(Arrow indicates location of 2012 photograph)

© SDAC

The site after 15 years showing the development of vegetation – November 2012

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