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Revetting and Supporting River Banks

4.2 Willow mattress revetment

RIVER SKERNE

LOCATION – DARLINGTON, Co DURHAM, NZ301160

DATE INSTALLED – OCTOBER 95

LENGTH – 59 METRES

COST – £164/METRE

NOTE: A full description of this technique is provided in the Environment Agency R & D Technical Report W83:- *Revetment Techniques used on the River Skerne Restoration Project* (1998)



Mattress revetment under construction – October 1995

Note: Additional poles inserted to close up spacing after photo taken

Description

This technique demonstrates revetment using willow branches that may be readily to hand in riverine situations through routine maintenance or pollarding of trees. They are laid along the reformed river bank and secured with sheep netting such that rapid growth of willow shoots will initiate a long term ecologically sustainable revetment.

Enhancements to the basic concept include the use of underwater rock, plant pallets at water's edge, and standard trees along the upper bank.

Revetment was needed to protect a gas main in the bank and loose backfill closing off a length of redundant channel.

Design

Below water

Crushed rock was used to line the newly excavated channel around a sharp bend, as well as the initial infill of the redundant channel (fill 1). Few alternatives to rock were practical in this urban situation, but rock does form a flexible revetment which

tree roots and aquatic flora/fauna will colonise. Most importantly, the rock used was mixed at the quarry to provide a densely graded '0.3m down' matrix to the following specification:

General Rock Revetment Specification (used throughout)

Hard, dense, homogeneous, frost resistant, local rock free from foreign matter

% passing	Sieve size (mm)
100	300
40 – 50	125
30 – 45	75
20 – 40	37.5
10 – 30	10
5 – 20	5
0 – 10	0.6

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Matress revetment after 2 years

As an alternative to rock, tree branches may be secured underwater by stapling to sheep netting to form a floating mattress which is then loaded with soil fill to sink it in to place. (Ward *et al.* 1994)

Water's edge and lower bank

The newly aligned and graded river bank was formed to about two thirds height by filling on top of the underwater zone described above. Rolls of sheep netting, cut to length, were incorporated under the fill as shown.

Selected live crack and white willow poles, 0.05m – 0.1m diameter, were then laid horizontally all along the face of the fill and pressed into it. Finally the free ends of the netting were drawn tightly over the poles and secured to stakes driven well back in the fill. Due to the shortage of willow locally, up to 30% non-regenerative sycamore was incorporated intermittently. The netting was stapled to the poles to create a structurally integral unit.

Upper bank

This was made up with fill, leaving a ledge, and seeded with grass.

As a final measure, pre-planted coir pallets were fixed along the water's edge to provide visual amenity and variety of habitat. The following year, standard trees were planted along the upper ledge. These may outgrow the revetment willow as they mature, provided the latter is regularly coppiced.

Subsequent performance 1995 – 2001

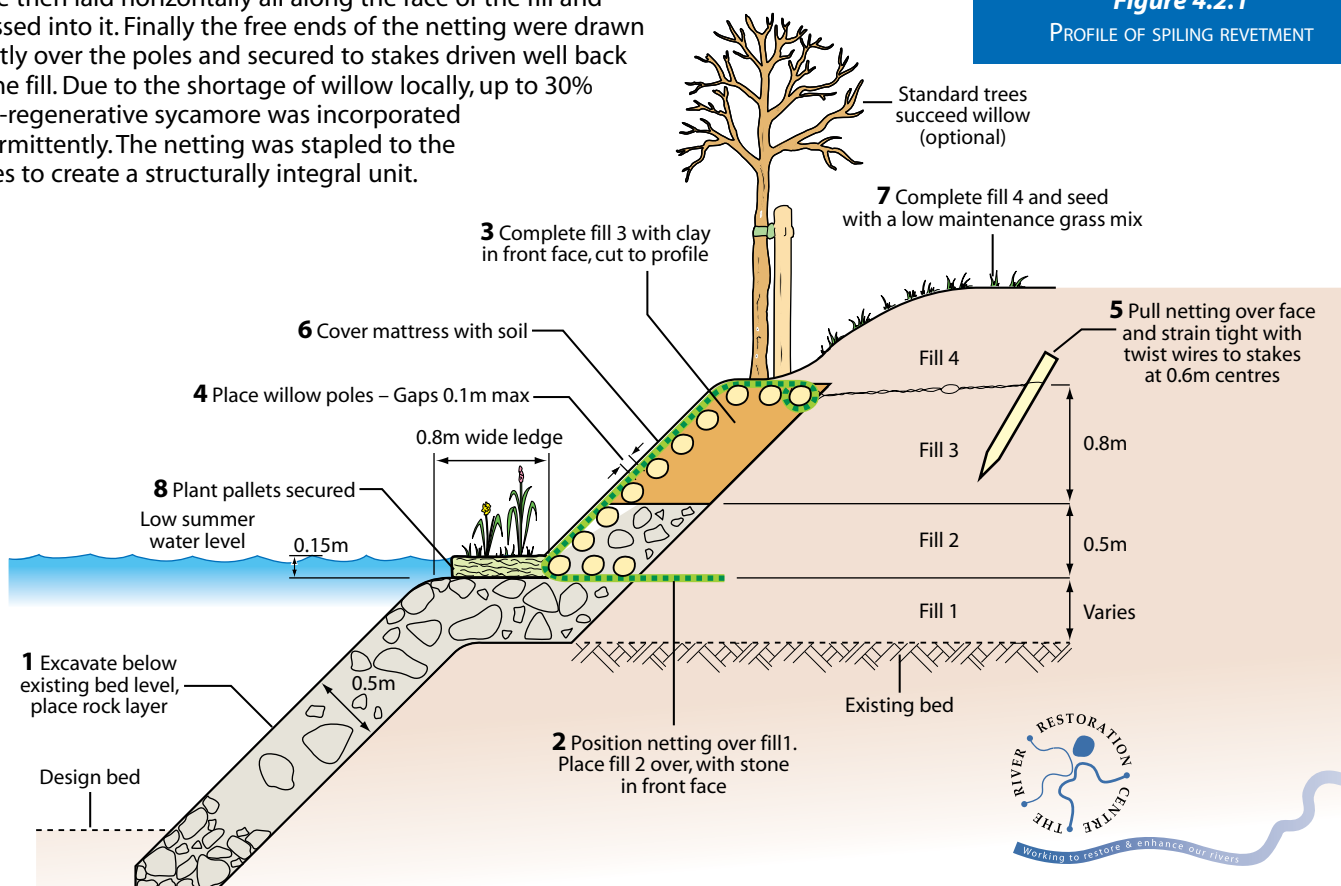
The revetment has remained stable, and dense willow growth up to 3m high covers the bank. Marginal sedge and iris complete what is a most desirable habitat niche favoured by water voles and birds.

Due to autumnal installation, no growth of willow occurred for the first 6 months, when winter floods washed out some soil. Since then the situation has reversed and silts are accumulating within the willow whilst roots extend into underlying soils and rock.

Rotational coppicing is planned, cutting around one third of the willow annually, as part of a river bank maintenance programme. On the Clwyd (Ward *et al.* 1994) no maintenance has been undertaken for 20 years and large trees have developed without hindrance by the netting which is now subsumed within the trunks.

Figure 4.2.1

PROFILE OF SPILING REVETMENT



These techniques were developed to suit site specific criteria and may not apply to other locations

