3 Enhancing Straightened River Channels

3.1 Current deflectors

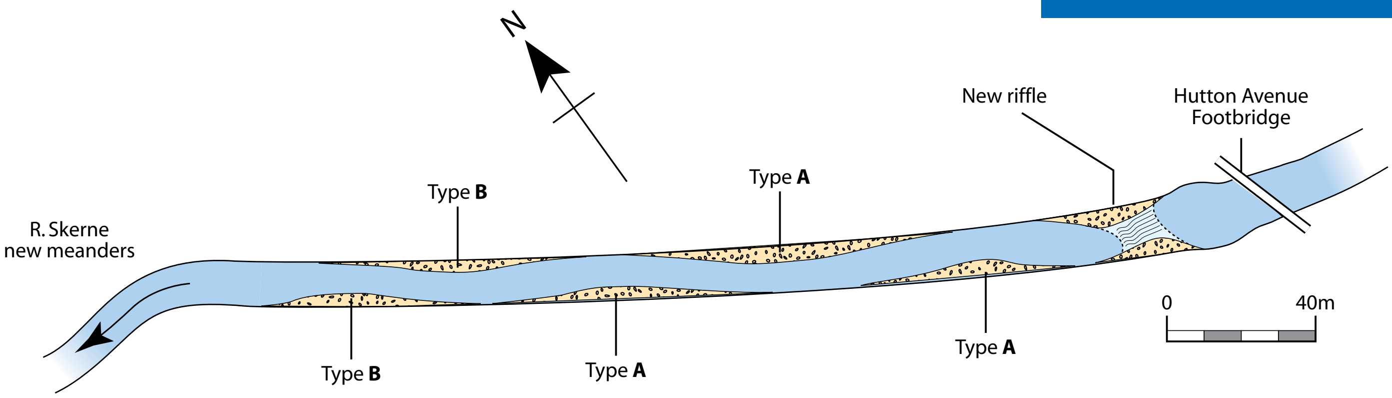
River Skerne

Location - Darlington, Co Durham, NZ301160

Date of construction - August 1995

Cost – Type A - £1,100, Type B - £900

Figure 3.1.1
Plan of location of deflectors



Description

The river had been straightened and enlarged to carry floodwaters safely through an urban area. A gas main runs parallel to one bank and contaminated landfill lies close to the other. The channel was uniformly trapezoidal although bank toes had been eroded. No diversity in the shape of the bed or banks, or of flow currents, existed and the ecological and visual amenity was poor.

View downstream before deflectors constructed

Diversity was introduced by building a series of low level structures in the bed that intermittently narrowed the channel causing variation in flow currents and localised pockets of erosion and deposition (deepening of the bed and accreting at the banks). The structures were necessarily small scale to avoid creating any scour of the river banks or significantly impeding flood flow.

Design

A series of artificial shoals were built, projecting up to one third of the way across the river bed (3m shoals in 9m bed). The shoals were semi-eliptically shaped in plan and elevated above normal water level by only a small amount. Their spacing along the reach varied, but they were placed on alternating sides of the river to encourage a small degree of sinuosity to the normal flow regime.

As this form of shoaling was not natural to the straightened reach, the design needed to impose conditions that would generate and sustain both scour and sediment deposition. This was achieved by incorporating a series of current deflectors, of varying length, out from the water's edge. These impede river flows, causing scour at their tips, whilst creating eddy currents within which silt is deposited closer to the bank. The anticipated form of silt deposition was simulated by adding stone and clay between the deflectors to initiate shoal formation.

Tree trunks (logs) of c. 300mm diameter were specified for deflectors as this is the most suitable material generally available near rivers, although all were imported at this urban location. Logs were secured with fence posts and wire after setting to line and level on a bed of stone.

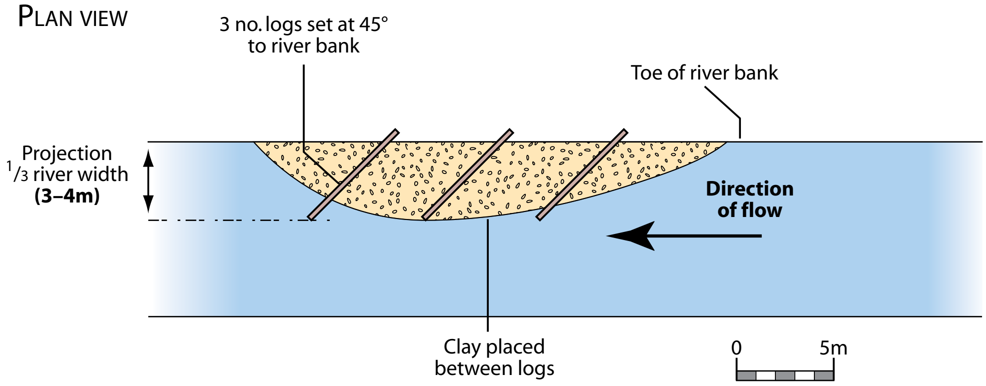
Two variations of the designs were introduced. The deflectors of 'type **A**' point downstream (*Figure 3.1.2*), whereas those of 'type **B**' (*Figure 3.1.3*), point upstream. This was done to help determine the most effective alignment for future application of the technique.

The height of the deflectors above normal water levels was also important. If set too low they would not create enough flow variation or visual benefit but if set too high they would create excessive erosion and would resemble terrestial features.

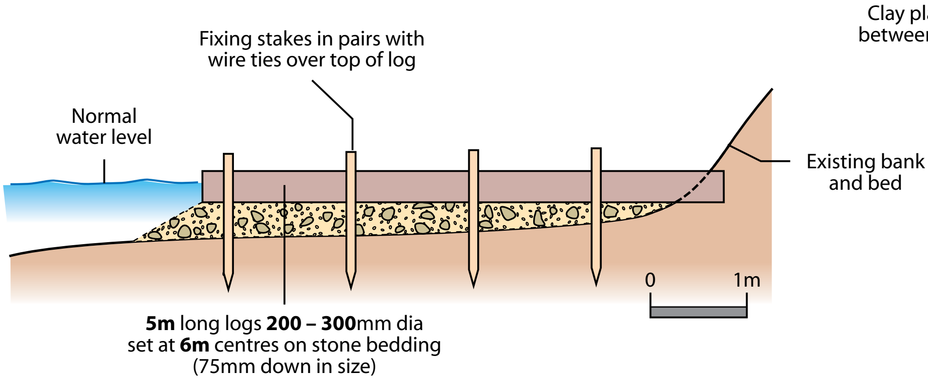
These techniques were developed to suit site specific criteria and may not apply to other locations

Figure 3.1.2
TYPE **A** DEFLECTOR

PLAN VIEW



SECTION THROUGH LOG



Type **A** deflector
– vegetation established

The type **A** deflectors were specified at about 200mm above water level and type **B** sloped from 300mm above water level at the bank down to water level at the projecting end.

Some planting using marginal species was planned for the end of the first winter's season after the river had adjusted the shape of the 'as built' structures.

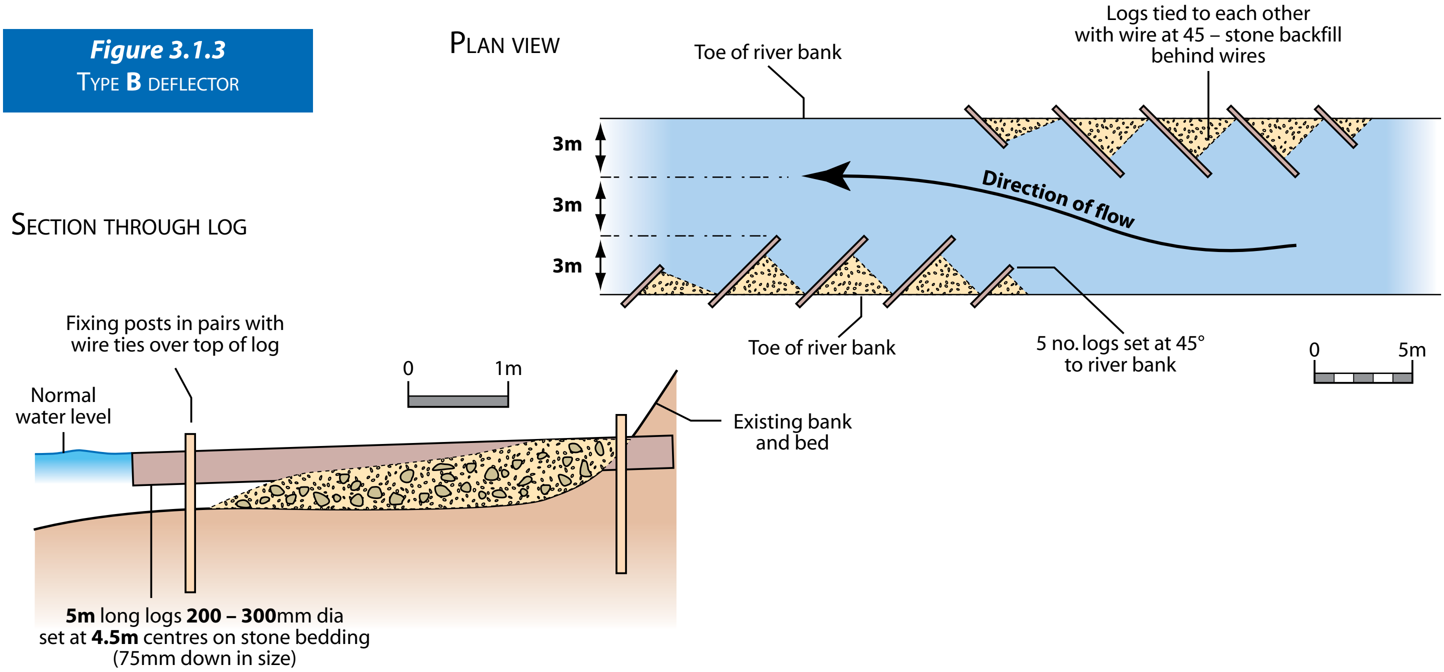
Subsequent performance 1995 – 2001

Whilst the deflectors have added a useful degree of diversity to the reach, this was not achieved without post-works modification following reaction by the river to their imposition; particularly those of 'type **A**'.

The primary difficulty was experienced when setting the level of the deflectors in relation to the normal range of low water levels; a critical factor. Deflectors were installed at the start of extensive river restoration works further downstream, when water levels were temporarily raised. Consequently, the 'type **A**' deflectors were set higher than designed and 'type **B**' were set lower. Live willow logs were used in 'type **A**' and inevitably began to grow, threatening to cause obstruction to flood flows.

Type **B** defelctor before planting

Figure 3.1.3
Type **B** deflector



As a result of these factors, over winter floods washed out much of the fill from 'type **A**' deflectors, leaving them perched above the water level, and causing erosion of the opposite river bank. Conversely, 'type **B**' deflectors had no discernible effect on the river regime.

Repairs to 'type **A**' deflectors comprised removal of the logs and replacement with pre-planted fibre rolls set at the surviving shoal level, as well as some planting using fibre mattresses. 'Type **B**' were not modified but some plant pallets were introduced near the bankside.

Subsequently 'type **A**' deflectors continued to adjust but show signs of becoming stable at about the levels designed and indicated in the figure. Small pools exist just downstream and currents are discernibly faster through the narrows created. 'Type **B**' deflectors remain less evident and would ideally be raised in level to bring them up to those designed.

The technique appears to be very worthwhile, but success is clearly sensitive to the size and level of the structures introduced. Both types were further enhanced by adjoining marginal planting at a later date (*see Technique 3.2*).