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for land and water management.

River Restora
Silsoe Campus
Silsoe MK45 4DT

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ld.ac.uk

Further reading

River Restoration Centre (1998)
Manual of River Restoration Techniques, Silsoe, ISBN 1 902872 00 2

River Restoration Centre (1998)
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Environment Agency R&D Technical Report, Environment Agency, Bristol

River Restoration Centre (1996)
River Skerne Restoration Project Reach; Site Man, River Restoration Centre, Silsoe

Ward D, Holmes N T H & Jose P (1994)
The New Rivers and Wildlife Handbook RSPB, Sandy, ISBN 0 7154 98 700

Photographs: River Restoration Centre

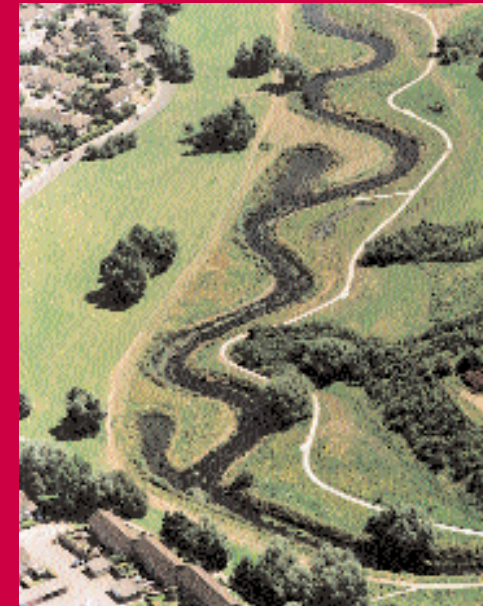
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CASE STUDY 13

Riverbank restoration through bio-engineering

Introduction

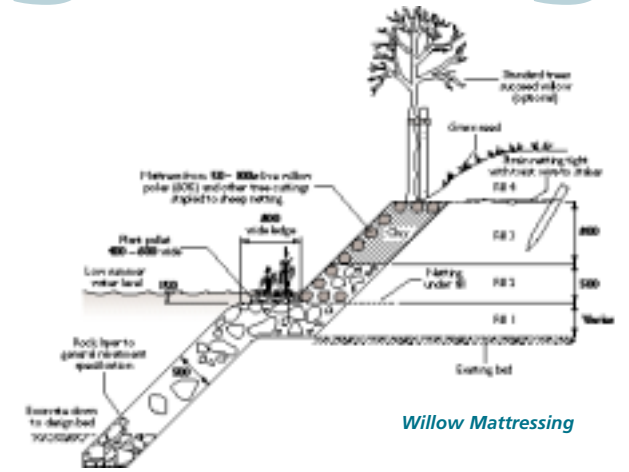
The use of trees, both dead and alive, for riverbank stabilisation has been in practice for centuries in rural areas. The more recent trend for *soft* engineering solutions in urban areas has progressed from synthetic geotextiles to the use of live materials, often in combination. The use of certain tree species can provide habitat, shade and landscape improvements in addition to cost effective ground stabilisation and erosion protection.

Willow matting under construction



Willow Mattressing

Above the rock toe the newly aligned and regraded riverbank was formed to about 2/3 height. Sheep netting, cut to length from rolls, was incorporated under the fill. Live crack willow (*salix fragilis*) and white willow (*salix alba*) poles (50-100mm diameter) were laid along the face and pressed into it. The free ends of the netting were then drawn up over the bank and tightly secured with stakes. The netting was stapled to the poles to create a structurally secure and flexible unit.



Willow Mattressing

Specific example

Project name and location

RIVER SKERNE RESTORATION PROJECT, Darlington, Co Durham, UK.
Grid reference: NZ 301 106

Project partners

- River Restoration Centre (RRC)
- Darlington Borough Council (DBC)
- Environment Agency (EA)
- Northumbrian Water plc
- Countryside Agency
- Local Schools
- English Nature
- Durham Wildlife Trust (DWT)
- Rivers Agency
- Heritage Lottery Fund
- EU LIFE programme

Project objectives

- To protect newly created river bends from erosion
- To promote a variety of innovative bioengineering revetment designs
- To demonstrate the effectiveness of natural materials for bank stabilisation.

Site description

The re-meandered river Skerne flows through urban parkland surrounded by housing and old industry. Much of the floodplain has been raised by industrial waste tipping. Housing development, gas and sewer pipes, and electricity cables bound the new course.

Consultation

A community liaison officer was employed to aid planning and design and to discover community concerns and post project views. A working group, made up of all the partners, served to develop the project.

Project Design

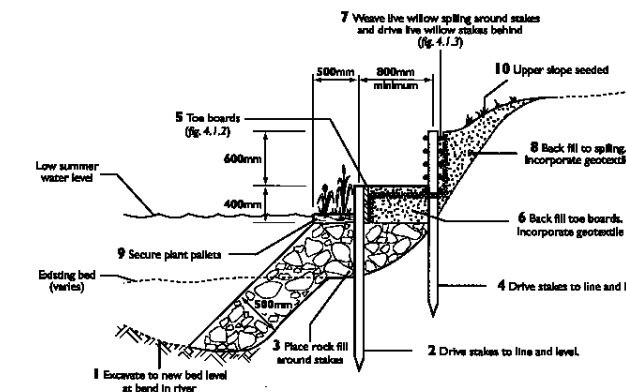
Meanders on the north bank had been formed within unstable landfill. Revetment was needed to prevent erosion towards a nearby gas pipeline.

Three techniques using willows were used:

- Willow mattressing with crack/white willow.
- Willow spiling with osier
- Log toe and geotextile incorporating grey/goat willow slips/rooted plugs.

Each technique followed similar design principles:

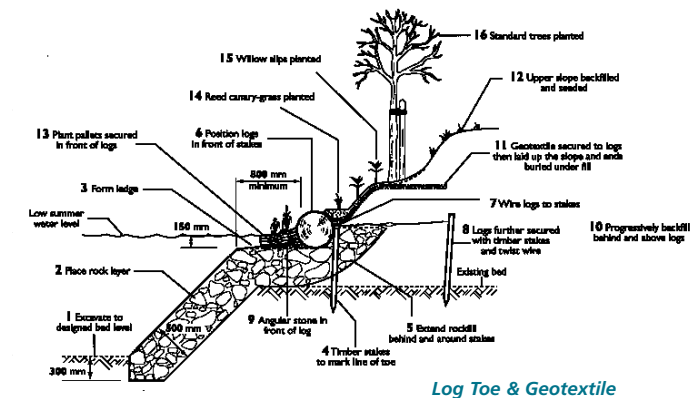
- Below water a densely graded rock matrix was used to form a protective toe at depth.
- At the water's edge the rock was formed into a shelf and was used to support reed planted pallets.
- Vegetative material was introduced to the damp zone above the ledge, protecting the lower bank. Upper banks were seeded and some standard trees planted.



Willow Spiling

Log toe and geotextile

Tree trunks and large branches c. 400 mm diameter were placed along the rock shelf and secured to fencing stakes to form the new river bank toe. These logs were partially submerged. The new river bank was formed with soil placed behind to approximately half bank height. Geotextile mattress was secured to the logs and spread over the backfilled face and buried under the remaining fill, bringing the bank to full height. Willow slips/pot grown plants were set into the lower bank. Standard trees were planted on the bank above the geotextile and various wetland plants were established along both the back and front of the toe logs.



Log Toe & Geotextile

Results

- No significant erosion to the banks after four years despite numerous flood events.
- White and crack willow both grew vigorously, grey willow did less well and goat willow failed. The growth rates and density of the thriving species meant full cover was achieved throughout.
- The benefit to the visual amenity and wildlife habitat is widely acknowledged by local people, and is expected to improve further.
- From the independent public perception survey of 250 residents, overall 82% of the local community approved of the River Skerne project
- The River Skerne Restoration Project was awarded the 1999 Civic Trust Special Award for Landscape, as well as five other national awards.

Management

These restoration techniques are self-sustaining, due to the use of the trees and wetland plants, but do require maintenance. Thinning and pollarding of the trees is undertaken as part of the site management plan. By dividing revetments into three sections and cutting each on a three year rotation, continuous bank support and cover for wildlife is provided. Selected trees may be allowed to grow to maturity.



Spiling after two years