



Advisory Visit
River Churnet, Staffordshire
May 2011



1.0 Introduction

This report is the output of a site visit undertaken by Tim Jacklin of the Wild Trout Trust to the River Churnet near Denstone, Staffordshire, on 12th May, 2011. Comments in this report are based on observations on the day of the site visit and discussions with Paul Deaville of JCB Angling Club.

Normal convention is applied throughout the report with respect to bank identification, i.e. the banks are designated left hand bank (LHB) or right hand bank (RHB) whilst looking downstream.

2.0 Catchment / Fishery Overview

The River Churnet is a tributary of the River Dove and subsequently the River Trent. The Churnet catchment area is largely located in northern Staffordshire and includes the towns and villages of Leek, Cheddleton, Alton and Rocester. The catchment is located in the Potteries and Churnet Valley Natural Area (www.naturalareas.naturalengland.org.uk/Science/natural/NA_search.asp) and the steep-sided valleys of the River Churnet and its tributaries hold some of the richest sites for wildlife in Staffordshire. In part, the diversity of the Natural Area is the result of it forming an upland fringe to the southern Pennines; habitats transitional between those of lowland and upland areas are characteristic of the Potteries and Churnet Valley Natural Area.

The Churnet Valley is associated with Carboniferous Permo-Triassic sandstones, overlain with brown earths and podzols. In cutting through the Upper Carboniferous (Silesian) Coal Measures, the River Churnet has exposed both coal and the Froghall Ironstone; these have been well-worked in the past, the resulting spoil being generally base-rich, even where the surface layers are acidic. Extensive land slips have occurred on the steep valley sides where flushes and tufa springs are frequent. Coarse-grained gritstones outcrop along the Valley, whilst river deposits form the valley floor.

The area has a history of industry including those associated with the nearby Potteries (e.g. flint milling), the textile industry in Leek (dyeing and finishing) and metal processing (copper works at Froghall). Industry altered the physical characteristics of the river in the form of mill weirs and alterations for navigation (Caldon Canal) and also severely impacted upon

water quality. The Churnet was chronically polluted for many years as a result of discharges from sewage works and industry, particularly the dyeing industry in Leek. In 1989, following a successful legal challenge by a local angling club, the then Severn Trent Water Authority invested heavily in effluent treatment resulting in a marked improvement in water quality. The cessation of many of the formerly polluting industries has also contributed to the long term improvement. There is however still the potential for the occurrence of acute pollution incidents and the Churnet has had more than its fair share in the last two decades, including serious fish kills caused by spills of bleach, pesticides and farm slurry.

Fish populations in the Churnet comprise a mix of trout, grayling and coarse fish species (including chub, dace, perch, and pike). The gradient of the river lessens in its middle reaches (around Cheddleton) and has a number of impoundments; here coarse fish tend to predominate. In the upper river (around Leek) and the lower river (downstream of Froghall) where the gradient is steeper, the habitat characteristics favour trout and grayling.

Salmon have been introduced to the river in the last decade as part of a project to restore the species to the Trent catchment. This project, led by the Trent Rivers Trust and the Environment Agency, has introduced juvenile salmon to the rivers Dove and Churnet. These fish have migrated to sea and returned as adult salmon which have been observed leaping at weirs at Rocester and Crumpwood in the autumn. The return of salmon is a testament to the improved water quality of the Churnet, but substantial improvements to fish passage are required at such weirs to ensure a self-sustaining salmon population becomes established.

JCB Angling Club control the fishing on the Churnet in its lower reaches approximately from the Dove confluence upstream to Crumpwood Weir. The reach upstream of Quixhill Bridge almost to Crumpwood Weir, a length of approximately 1.9 km, is reserved for fly-fishing and this was the section inspected on this visit (Figure 1). JCB AC control a number of coarse fishing lakes and only a small proportion of the membership currently fly-fish on the river. No fish are stocked into the river and the fly-fishing members practise catch-and-release to conserve the natural stocks of trout and grayling.

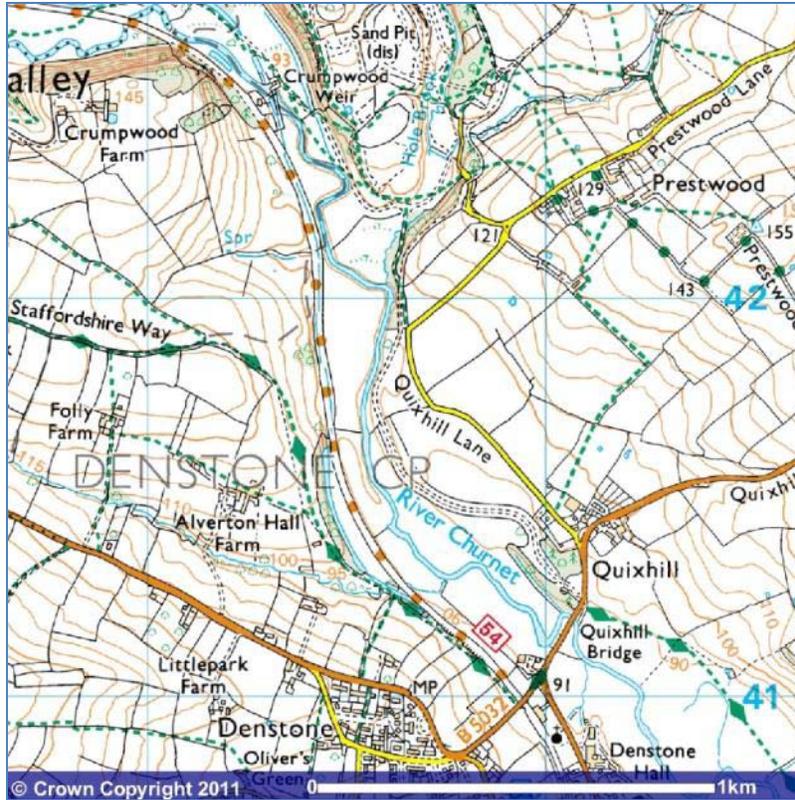


Figure 1 JCB Angling Club fly-fishing section, between Quixhill Bridge and Crumpwood Weir (approx.). The river flows NW to SE. (Image reproduced with permission of Ordnance Survey: www.ordnancesurvey.co.uk/getamap)

The Humber River Basin Management Plan (under the Water Framework Directive – see www.environment-agency.gov.uk/research/planning/33106.aspx) lists this section of the Churnet (from Consall to the River Dove) as a heavily modified waterbody with a current overall ecological potential of ‘moderate’. This is because of physical modifications to the river channel, although the specific nature of these is listed as ‘unknown’. However, the biological elements contributing to the overall potential are listed as ‘good’ for fish and ‘moderate (good by 2015)’ for invertebrates.

3.0 Habitat Assessment

The plan-form and the natural processes of erosion and deposition form the basis of good habitat within rivers. Meanders, with associated erosion and deposition, form pools, gravel bars and riffles (Figure 2); these in turn

provide a diversity of depth, flow speeds and well-sorted river bed substrate (cobble, gravel, sand, etc.), the physical elements of habitats for aquatic plants, invertebrates and fish.

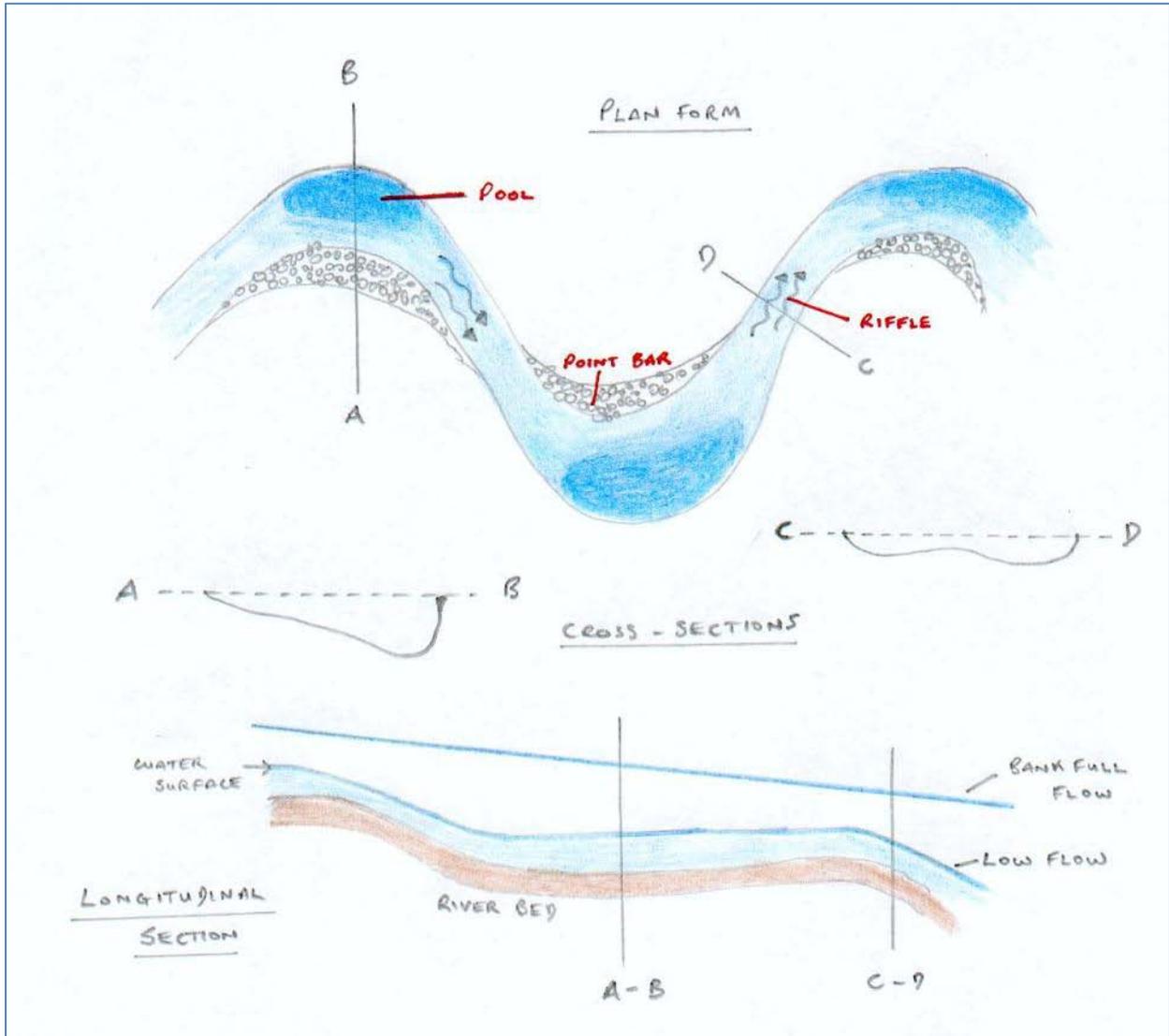


Figure 2 Natural channel morphology in alluvial rivers (adapted from Prof. Richard Hey, 2005)

On this reach of the Churnet there are some good examples of a natural plan-form and good habitat on the downstream and upstream sections (above Quixhill Bridge and downstream of Crumpwood Weir), but the middle section has been subject to channel modification which has restricted natural processes and prevented good habitat from developing. The middle section of river is relatively straight and has stone revetment at the toe of the bank

(Photo 1) which has effectively stabilised the river channel in position, preventing the dynamic processes of erosion and deposition from shaping a natural river channel. The revetment has been in place for many years as evidenced by the mature trees growing above and amongst it.

The way land adjacent to the river is managed is a key consideration which affects the rate at which erosion takes place. The bank revetment was undoubtedly installed with the intention of stabilising the river and preventing erosion and 'loss' of land used for agriculture. Yet it is the use of riverside land for agriculture which actually reduces its resilience and increases the rate of erosion (Photo 2). This can be seen by contrasting the rates of erosion on banks grazed right up to the river margin with those where the banks are wooded.

In some places, the stone bank revetment has begun to fail and limited areas of bank erosion are starting to develop (Photo 4). The response to this could be either:

- To repair the bank revetment and maintain the status quo of relatively poor river habitat in this area;
- Or allow (or encourage) the bank revetment to fail and a more natural river plan-form and better habitat to develop.

The latter option requires an acceptance from land managers that the river channel will begin to move from its current course and create meanders which will encroach on land currently used for grazing / mowing. Consideration should be given to changing land use practices within the river corridor to so that these dynamic natural processes can occur at more natural rates. Creating woodland in fields adjacent to the existing revetment would give time for trees to become established and increase the resilience of the land whilst the revetment is allowed to decay.

The erosion on the left bank above Quixhill Bridge (Photo 2) is taking place at an accelerated rate and is likely to break through the headland in the field and cut off the meander in the not-too-distant future. Defending the bank against this erosion with hard revetment (like further upstream) would be expensive, have a high risk of failure and would compromise the sand martin colony present in the river cliff. An alternative option would be to temporarily defend the toe of the bank with soft revetment (e.g. log and Christmas tree) to slow the rate of erosion whilst planting the headland with

native trees to create a copse, thus increasing the land's resilience to erosion.



Photo 1 Hard bank revetment on the middle section of the JCB water on the Churnet



Photo 2 Bank erosion near Quixhill Bridge



Photo 3 Large woody debris (note the scoured, cleaned gravels suitable for spawning trout in the foreground).

Unfortunately the River Churnet is host to a number of undesirable, invasive, non-native species including the signal crayfish (*Pacifastacus leniusculus*); these are known to be present in large numbers upstream of Crumpwood weir. Two plants, Himalayan balsam (*Impatiens glandulifera*) and Japanese knotweed (*Fallopia japonica*) are present and these species can form large stands along river banks, shading out native plant life. An additional problem is that they die back in winter leaving banks bare and exposed to increased rates of erosion. Advice on controlling these plants can be found at <http://publications.environment-agency.gov.uk/pdf/GEH00410BSBR-e-e.pdf>.

It is strongly recommended that early action is taken to control the Japanese knotweed whilst the stands are relatively small. Please note the ease with which knotweed can be spread from the smallest fragment and do not trim or flail these plants. Herbicide (bioactive glyphosate) application by spraying or stem injection is probably the most effective treatment (note the requirement for Environment Agency consent for using herbicides alongside watercourses).

Large woody debris (LWD) is a very important component of a good river habitat. LWD is a general term referring to all wood naturally occurring in the channel including trees, branches, stumps and logs. LWD is generally derived from trees located within the riparian corridor and rivers with adequate LWD tend to have greater habitat diversity, a natural meandering shape and greater resistance to high water events (Photos 3, 4).

Traditionally many land managers and riparian owners have treated LWD in streams as a nuisance and have removed it, often with uncertain consequences; this is often unnecessary and harmful. Stream clearance reduces the amount of organic material which supports the aquatic food web and removes vital in-stream habitats that fish will utilise for shelter and spawning. In addition LWD increases the diversity of flow and depth through localised scour and deposition, sorting and grading river bed materials into vital habitats for invertebrates and fish spawning. An excellent example of this can be seen in Photo 3. Areas of clean gravel such as this are at a premium in the Churnet catchment because of the sandy nature of the geology, so their preservation should be a high priority.

LWD can also have significant benefits to the control of run-off at the catchment scale, helping to regulate the energy of running water by

decreasing the velocity and increasing the 'travel time' of water across the catchment (to the benefit of downstream urban areas).

It is therefore important that naturally occurring LWD is retained within the river wherever possible. LWD could be deliberately introduced to the river in the form of tree sweepers. These are bankside trees which are felled and fixed to their stumps, mimicking naturally occurring stable LWD.

Trout spawning habitat comprises beds of well-sorted, loose gravel in the 5 – 50 mm diameter size range with a flow velocity of around 25 – 75 cm per second (Photo 5). Nearby cover (deeper water, undercut banks, tree roots, etc.) is also important to provide a bolt hole for spawning fish. Because of the sandstone geology of the Churnet catchment there tends to be a large proportion of finer sediments in the river bed substrate; this compromises the survival rate of trout eggs which remain buried for several weeks and require a reasonable flow of water through the spaces between the gravel. The sandy nature of the Churnet is a fact of life and the options for improving trout recruitment are:

- Retaining / introducing LWD to sort gravels (as described above)
- Improving fish passage (see below) to improve connections between spawning tributaries and the main river
- Improving the survival rates of juvenile trout by habitat improvement

The first year of life is when trout suffer their highest mortality (typically 95% plus); by comparison, fish over one-year old have an annual mortality rate of around 50 – 70%. Improving survival rates during the first year, even by a small percentage, can lead to considerably more fish reaching adulthood. This can be achieved by introducing abundant bankside and in-stream cover, for example:

- 'hinging' small trees and branches into the river margins by partially sawing through the trunk and leaning them over;
- Packing brushwood along river margins which lack abundant cover
- Introducing larger tree sweepers as described above;
- Encouraging aquatic weed growth (particularly water crowfoot *Ranunculus* sp.) by reducing shading in areas of higher water velocity (e.g. by coppicing or hinging adjacent trees)



Photo 4 Woody debris log jam – these provide good in-stream habitat and are often the catalyst for changing the river channel shape. Here the river has started to break through the hard bank revetment alongside the log jam; the response to this could be to allow the erosion to continue and start to create some varied habitat, or to remove the jam, repair the bank and stick with the relatively poor habitat.



Photo 5 The 'glassy' water at the tail of a pool like this is a favoured spot for trout spawning. It could be improved by providing low cover close by as a bolt-hole for spawning fish.



Photo 6 Low cover is excellent habitat for holding fish – don't remove it if carrying out trimming for angling access!



Photo 7 Branches and small trees which have collapsed into the river are superb refuges for juvenile trout. Leave them in place and try introducing a few more.



Photo 8 Larger trees also provide excellent cover and great fish habitat. Leave natural ones in place and consider introducing some “tree sweepers”.

If tree branches are trimmed to facilitate angler access and casting, bear in mind the importance of preserving low cover in or just over the water. There is no harm in trimming the odd twig or branch a few feet above water level, but removing the low cover could well remove the fish holding potential of that area (Photos 6, 7, 8).

Bankside trees play important roles by maintaining resilient banks, providing shade which regulates water temperatures and being habitats themselves for a range of species. Long sections of the Churnet have a single tree line (mostly alder) and grazing alongside the river is preventing new trees from becoming established. The lack of succession of trees means that as older individuals are lost, there is nothing to replace them, leading to increased rates of erosion as noted above.

Alder trees can be subject to the disease *Phytophthora* which kills them, accelerating the process of tree loss and bank erosion. Early coppicing of trees showing signs of disease can promote re-growth, preserving the trees root mass and its bank stabilising properties (Photo 9). Any trees which are already dead should be left standing as they are valuable habitats. Creating wide, ungrazed buffer zones and headlands alongside the river or changing floodplain land use to woodland, will allow trees to become established by natural colonisation or planting.

Although Crumpwood weir is not on the JCB AC stretch, it is located a short distance upstream. This structure forms a very significant barrier to fish migration and in recent years salmon have been observed struggling to leap the weir (Photo 11). It is well-known that salmon undertake long migrations between river and sea to complete their lifecycle; what is less well-known is that other species like trout and coarse fish also migrate over varying distances and timescales for spawning, feeding and refuge. For example, trout move upstream and into small tributaries in the autumn in order to spawn and then their offspring subsequently drop back downstream.

Improving fish passage at structures like Crumpwood has obvious benefits for salmon but would also significantly improve the populations of other species like trout, increasing their abundance and resilience across the catchment. Building a fish pass (Photo 12) at Crumpwood would be an expensive (circa £250K) project but has great potential for good publicity, education opportunities and partnerships between the private (industry), public (Environment Agency) and voluntary sectors (Trent Rivers Trust, Wild Trout Trust).



Photo 9 A coppiced alder tree showing re-growth from the stump. In this case the tree has been coppiced because it is under power lines, but it illustrates what can be done to manage riverside alders to increase their longevity. A rotational coppice of ten years or more ensures that there is a good mix of stages of re-growth and channel shading. Coppiced trees must be protected from grazing.



Photo 10 A salmon attempting to leap Crumpwood Weir in late 2010 (Picture: Mick Buxton).



Photo 11 A fish pass built around Tutbury Weir, River Dove. A similar structure could be built at Crumpwood to be in keeping with the local surroundings and existing stonework.

4.0 Recommendations

- Retain large woody debris within the river channel wherever possible. Introduce woody debris in the form of tree sweepers (Figure 3), hinged trees and bushes (Photos 12, 13), or brushwood bundles (Photo 14). Target areas alongside potential spawning areas (e.g. Photo 5) and downstream of these where juvenile fish might be protected.
- Consider allowing the hard revetment on the middle section of the river to degenerate and the river to move within its floodplain corridor. Discuss this with land managers responsible for adjacent land and the possibility of changing floodplain land use, e.g. to woodland. If a complete land use change is not possible, then consider creating a wide riverside margin and headlands (e.g. alongside the eroding bank in Photo 2) where woodland can be planted. (Photo 15).
- Protect the toe of the eroding bank above Quixhill Bridge (Photo 2) using a soft revetment technique such as log and Christmas trees (Photo 14). This should be done in conjunction with planting the adjacent headland with trees (Photo 15). Consult Staffordshire Wildlife Trust on the implications of this for the sand martin colony in this bank.
- Control the invasive weed species Japanese knotweed and Himalayan balsam. Spraying and/or stem injection of glyphosate (with EA permission) is probably the most practical approach.
- Assess alder trees for disease and whether they can be preserved by coppicing. Aim for about 60% shading of the channel, with open canopy areas alongside shallow, fast-flowing areas where water crowfoot will grow. Use the arisings from coppiced trees to introduce LWD to the channel.
- Consider building a partnership to take forward a fish pass construction project on Crumpwood Weir.

Please note, it is a legal requirement that all the works to the river require written Environment Agency (EA) consent prior to undertaking any works, either in-channel or within 8 metres of the bank.



Photo 12 Willow tree hinged into the margins of the River Goyt (Derbyshire). Partially cutting the trunk and pushing over the tree will ensure a firm anchor point. This particular example has been retained through many floods which over-topped the bank.



Photo 13 Tree kicker / sweeper. Tree felled and fixed to its stump with cabled wire (River Goyt, Derbyshire).

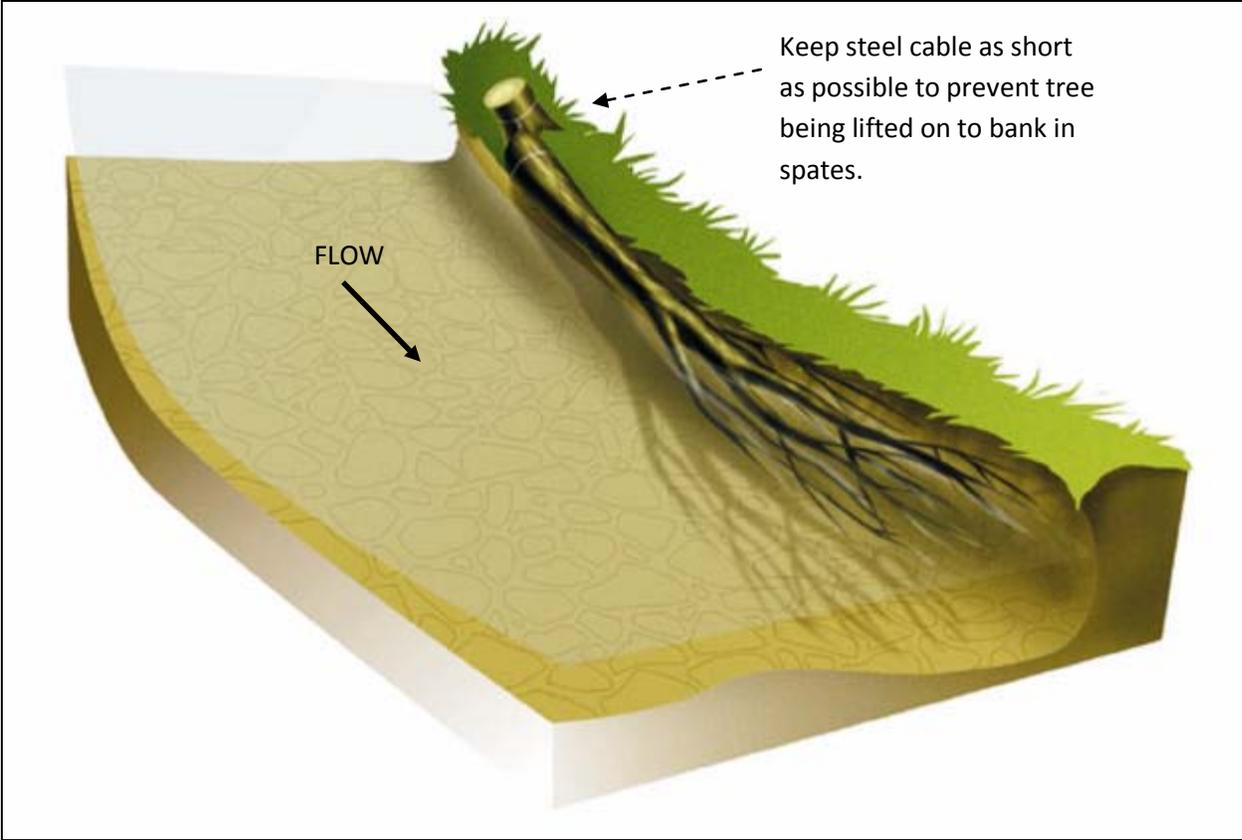


Figure 3 Schematic of tree kicker / sweeper



Photo 14 This bank revetment made from conifer brush was installed to reduce the rate of bank erosion, but also proved to be superb cover for juvenile trout (River Manifold, North Staffordshire).



Photo 15 A tree-planted headland which has successfully slowed an excessive rate of erosion, River Clwyd, North Wales.

5.0 Making it Happen

The WTT can provide further assistance to help implement the above recommendations. This includes help in preparing a project proposal with more detailed information on design, costs and information required for obtaining consents to carry out the works. If required, a practical visit can be arranged to demonstrate habitat improvement techniques. Demand for these services is currently high but WTT is able to provide further advice and information as required. Please contact projects@wildtrout.org for more information.

6.0 Acknowledgement

The Wild Trout Trust would like to thank the Environment Agency for the support which made this visit possible.

7.0 Disclaimer

This report is produced for guidance only and should not be used as a substitute for full professional advice. Accordingly, no liability or responsibility for any loss or damage can be accepted by the Wild Trout Trust as a result of any other person, company or organisation acting, or refraining from acting, upon comments made in this report.