River Axe, Weycroft

An Advisory Visit by the Wild Trout Trust, March 2014

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Introduction

This report is the output of a Wild Trout Trust visit undertaken to the River Axe at Weycroft near Axminster, Devon.(National Grid Reference: SY 30470 99914to SY 30470 99914) in March 2014. The visit was requested by the land owners Allan and Margaret Howlings. The visit was primarily focussed on options to improve the river habitat for wild trout (*Salmo trutta*) and salmon (*Salmo salar)* and to sympathetically manage the reach as a private fishery.

Comments in this report are based on observations on the day of the site visit, and discussions with Mr. Howlings and Mike Holland of the Environment Agency (EA).

Throughout the report, normal convention is followed with respect to bank identification i.e. banks are designated Left Bank or Right Bank whilst looking downstream.

Figure 1: A map showing the section of the River Axe visited

Catchment and Fishery Overview

The River Axe rises from springs between Crewkerne in Somerset and Beaminster in Dorset, and flows west into Devon before turning southwest at Chard junction and flowing through Axminster, Colyford and Seaton. The Axe collects flow from Temple Brook and the River Synderford near its headwaters and the Blackwater River and the River Yarty in its midwaters. The Umborne Brook and the River Coly confluence with the Axe in the lower reaches before it enters the English Channel at Seaton Bay.

The underlying geology of the riverbed is alluvium with areas of valley gravel, clay, shale and marl. The water is base-rich (alkaline) with a high content of dissolved minerals.

For 13 kilometres, between the confluence with the Blackwater River and the tidal limit near Colyford, the river is designated as a Site of Special Scientific Interest (SSSI). The designation is due to the Axe supporting an exceptionally diverse range of aquatic and marginal plant species, as well as a number of threatened animal species including salmon, bullhead (*Cottus gobio*), otter (*Lutra lutra*) and medicinal leech (*Hirudo medicinalis*). The active morphology of the Axe, especially in the upper reaches, has ensured a physically diverse range of natural features are present. In addition, the lower reaches are contrastingly stable, further broadening the range of different habitat types within the river.

Sea trout (known locally as 'peal') and salmon stocks in the Axe reportedly crashed in the 1980s and early 1990s, most likely due to agricultural pollution and excessive erosion causing degradation of spawning habitat. Since then a native broodstock scheme has been undertaken in an attempt to boost populations along with a number of habitat improvements such as weir removals and restoration of spawning beds.

In more recent years the reputation of the Axe as a healthy salmon and sea trout river has improved. However, the river is still failing its targets for macrophytes (plants) under the Water Framework Directive (WFD) and is suffering an overabundance of diatoms (algae), and phosphates, suggesting that agricultural pollution is probably still a significant issue.

Table 1: WFD Information for the Upper Dun

AXE	
Waterbody ID	GB108045008870
Waterbody Name	AXE
Management Catchment	East Devon
River Basin District	South West
Typology Description	Low, Medium, Calcareous
Hydromorphological Status	Not Designated A/HMWB
Current Ecological Quality	Poor Status
Current Chemical Quality	Good
2015 Predicted Ecological Quality	Poor Status
2015 Predicted Chemical Quality	Good
Overall Risk	At Risk
Protected Area	Yes
Number of Measures Listed (waterbody level only)	2

Habitat Assessment

For the purposes of this report, the section of the river visited is described from the upstream extent of the Howling's water, at Weycroft Bridge, to the downstream boundary where the river is crossed by the West of England Main Line railway.

At the top of the reach, the river passes under Weycroft Bridge via two arches and almost immediately bends sharply to the left. The sill protecting the bridge footings and the arches themselves restrict conveyance during high flows and act as a flow 'throttle'. Water is accelerated under the bridge and this has scoured a deep pool immediately downstream. The accelerated flows in combination with the abrupt bend in the river make the right bank (RB) particularly vulnerable to excessive erosion and to tackle this issue a hard revetment protects the bank at the bottom of the garden.

As is often the case with hard-engineered structures, the revetment absorbs little of the energy of the flow and instead simply deflects it downstream. As a

result, the hard-soft interface, where the hard revetment ends and the natural bank begins, is bearing the brunt of the erosion (Figure 2).

Figure 2: Erosion at the hard-soft interface on the downstream edge of the hard-engineered revetment

The deep scour pool is a good holding pool for trout and the material scoured out from the pool has formed a shallow riffle downstream. This illustrates the active morphology of the River Axe and how spate flows diversify the physical characteristics of the channel.

Figure 3: Material scoured out from the pool below the bridge has formed a riffle downstream (image taken facing upstream)

Physical diversity is central to supporting a healthy and diverse river ecosystem and subsequently a healthy habitat for wild trout and salmon. Trout in particular thrive in more physically diverse rivers as they are naturally territorial and will defend their territory from other trout. The more diverse the habitat, the more micro-territories there will be for trout to occupy within a given area. Diversity is also crucial in ensuring that the correct habitat is available for the different life stages of salmonids. Clean, well-graded and well-oxygenated gravel is vital for successful spawning; shaggy marginal cover and shallow, stoney riffles are important for trout and salmon parr respectively; and deep pools, overhead cover and in-channel structure (such as fallen trees) form important territories for adult fish.

Considering the gradient of the river and the frequency of high flow events, the River Axe at Weycroft is very unlikely to provide spawning/nursery habitat. However, the reach is traversed by sea trout and salmon as they migrate between the sea and spawning sites upstream. The reach is also very likely to hold a good stock of resident adult brown trout.

Along the reach downstream of the house, running parallel to the A358 (Chard Road), there are some good examples of adult trout habitat. Along both margins (but particularly the RB), there are a number of pools directly below low-growing bankside willows (*Salix* spp.) (Figure 4). Submerged roots, low-lying branches and fallen tree limbs provide excellent cover from predators and create small pockets of slack water where trout can conserve energy and dart in and out of stronger flows to snap up passing food items.

Figure 4: Low-growing shrubby bankside willows provide excellent cover and shelter from fast flows.

These small sheltered areas will also provide an important refuge where trout can lie up during spate flows. In the spate-prone upper and middle reaches of the River Axe, the greater the number of large woody debris (LWD) features, the more likely it is to support good numbers of trout. These features are important refuge areas during high flows, and promote micro-territories that will also be occupied by trout during normal flow conditions. By capitalising on opportunities to increase the number and diversity of such features it should be possible to boost the carrying capacity of the reach for adult trout.

Coarse woody debris (CWD) consists of 'brashy' material such as submerged fine branches, brushwood and dense root systems which provide important refuge habitat for juvenile fish (parr). CWD introduces constricted, sheltered spaces where small fish can avoid larger fish and other predators. CWD also has a significant slowing effect on local flow conditions and provides excellent shelter during spate flows.

The micro habitat provided by this material is important for trout in particular because it acts as a visual barrier between individuals. From the moment trout fry emerge from the gravel they are instinctively territorial and rarely congregate in large numbers unless they are out of the line of sight of their neighbours. It also directly enhances parr survival by limiting the maximum

efficiency of predators – in contrast to excessive depletion of fish stocks in habitat lacking complex refuge structures.

Another important habitat for parr is emergent and marginal vegetation such as the emergent beds on the LB (Figure X). A 'shaggy margin functions in a similar manner to CWD, providing essential cover and an important interface between the aquatic and terrestrial environments. Emergent and marginal plants provide food and habitat for a range of invertebrates, small mammals and birds. In high-gradient rivers, aquatic plants such as water crowfoot (*Ranunculus* spp.) are often unable to establish on the bed. Primary production therefore occurs almost entirely in the margins of the river making marginal plant beds especially important. Other than marginal plants, the major source of biologically available energy in upland rivers comes from organic detritus such as fallen leaves. These feed a range of invertebrates which in turn are prey for fish.

Figure 5: Beds of marginal vegetation can be sparse in high-energy river systems and are therefore important to conserve

In high-energy rivers, marginal plant beds are often limited in their distribution by erosive conditions. Encouraging the development of marginal beds in depositional areas (such as in inside of meanders or in the lee of in-channel structures) could be a welcome boost to in-stream productivity.

As mentioned previously, leaf litter is an important part of the river ecosystem and bankside trees are therefore critically important. A further important role for

CWD is the retention of this nutrient-rich leaf-litter that would, otherwise, be washed out of the reach. Tree cover also provides shade which can help to keep rivers cool (and therefore well-oxygenated) during periods of hot, dry weather. With the possible effects of climate change causing increasingly more-extreme weather patterns, the role of tree cover in regulating river temperature may become increasingly important. However, direct sunlight is also important for productivity and so a balance of light and shade is required. Presently a roughly 50:50 ratio of direct sunlight to dappled shade is recommended. (http://www.wildtrout.org/sites/default/files/news/Keeping_Rivers_Cool_Guidance.pdf)

As the river bends to the right and away from the A358, the LB is steep and densely wooded, casting uniform shade over the channel. The tree cover is also high above the channel and not providing the low-lying overhead cover that trout favour. The opposite bank is comparatively bare (Figure 6).

A number of willow saplings have been recently planted on the RB. Willow is a particularly useful family of bankside trees because they are fast-growing and provided they have sufficient access to water, a stem cut from an existing willow and planted into the bank will grow into a new tree. This makes willow species ideal for bank stabilisation. In terms of fish habitat, smaller shrub species such as goat willow (*Salix caprea*), recognisable by its more rounded leaves, are particularly useful as they provide good low-level aerial cover. Because goat willows rarely grow particularly tall, they are also good for bank stabilisation; the shorter tree having less leverage and being less likely to topple over.

Figure 6: The LB is steep and densely wooded, casting uniform shade over the channel

The reach from the A345 to the railway bridge is relatively uniform in cross section and lacks the physical diversity observed in the river upstream. This is characterised by the comparatively laminar (flat) flow observed in the reach (Figure7). Fortunately, there is a significant opportunity to enhance the reach in terms of light conditions and physical diversity by undertaking some tree works on the LB and using the arising material to introduce some in-channel structure.

Figure 7: The reach from the A345 to the railway bridge is relatively uniform in cross section with laminar flow (image taken facing upstream)

Introducing LWD into a relatively high-gradient river is an action that must be undertaken carefully. Depending on the size of the tree/limb being used; the force of the flow; and the proximity of infrastructure (such as the railway bridge), introduced LWD will need to be firmly secured to bed or bank (or both). Methods for fixing LWD are discussed in the *Recommendations* section.

For the entirety of the reach, the land on the RB consists of a grassland meadow owned by Mr and Mrs Howlings. Rough grassland adjacent to rivers can be very important in the lifecycle of many riverfly species as well as providing habitat for a range of terrestrial invertebrates which may also end up in the river and further supplement the river food web. Managing the meadow as wild grassland will have significant benefits for biodiversity both on land and in the river.

Upstream of Weycroft Bridge, an EA owned fish trap is situated on a large weir. The weir itself, which holds up the head of water which once powered Weycroft Mill, is virtually impassable to salmon and sea trout. It forms a significant impoundment which degrades habitat upstream and also interrupts natural sediment transport which may have a limiting effect in the diversity of physical conditions downstream.

The trap consists of a technical fish pass which can be altered to retain fish attempting to migrate upstream. In the past, the Environment Agency operated the trap in order to strip eggs and milt (sperm) from salmon and rear their offspring to the parr stage before returning them to the river. This scheme, like many others, was undertaken in combination with habitat improvements as an attempt to replenish the dwindling salmon run. In recent years, the EA has relinquished operation of the trap to the Axe Vale Rivers Association (AVRA) who operate a local broodstock scheme for both salmon and sea trout.

Figure 8: the Fish trap on the mill weir upstream of Weycroft Bridge

Increasing the survival rate of fish at the egg/fry life-stage (where the highest mortality rate often occurs) may seem like a logical method of improving fish populations, and sourcing broodstock from the same river as the parents may seem logical and sensible in terms of reducing risks to the genetic fitness of the stock. However, when removing precious wild broodstock from the river, it is imperative that the scheme is accurately monitored and that the number of returning adults produced, as a direct result of the scheme, is significantly more than those fish would have produced naturally if left in the river. A much more sustainable and less risky strategy is to identify the habitat bottlenecks, resolve the issues and facilitate increased levels of natural production.

Trout are an incredibly genetically diverse species which exhibit a remarkable range in phenotypes. They can be so diverse in appearance that for centuries it was thought that there were dozens, possibly even hundreds of different species of brown trout and sea trout in the UK. In reality there is only one native trout species, *Salmo trutta,* which is so adaptable that specimens from neighbouring catchments can differ significantly in appearance. This genetic diversity allows the species to adapt to environmental changes in just a few generations. However, artificial selection, no matter how sensitively undertaken can dramatically narrow the available gene resource of the population.

Salmonids do not take the 'genetic scattergun' approach to spawning that some shoaling fish do. The mate selection process is subtle and the fish will choose a mate based on a number of characteristics, including smell (chemical cues), which allow them to select a healthy and genetically compatible mate. This process is important in conserving the health of the wild population.
It is also worth considering that the fish trapped and stripped were on their way to natural spawning beds and the decision making process by which salmonids select a spawning site is also important. In a fully natural system fish that exhibit poor decision making when selecting a mate or spawning site have a much lower chance of successfully reproducing. Natural selection dictates that the individuals best-adapted to their environment will proliferate. Therefore the conservation of behavioural traits is equally as important as the conservation of genetic information.

More information can be found at http://www.wildtrout.org/content/trout-stocking

Conclusions

The River Axe downstream of Weycroft Bridge provides a relatively good habitat for wild trout including sea trout. The main limiting factor on the holding capacity of the reach is the modest quantities of cover and refuge habitat available. Opportunities exist to introduce additional habitat features. The weir upstream of the reach is likely to be limiting the morphology of the reach and the river would function more naturally if it were to be removed. However, as is often the case with mill weirs, the flow diverted through the old mill development is likely to be valued by the residents and removal may be dependent upon winning their support. This is something that should be proactively sought as communities often become more amenable to such suggestions if the full extent of an issue is adequately explained to them. Issues surrounding the additional flood risk at structures can often be a strong driver for environmental enhancement.

The trapping and broodstocking scheme presently operated by AVRA is unlikely to have a significant positive impact on wild fish population. It is possible that

the scheme may actually be doing more harm than good in the long-term. Robust and effective monitoring of native broodstock schemes is difficult, expensive and rarely undertaken. Where schemes have been properly evaluated they are usually identified as being just another adverse impact on stock recovery. Terribly disappointing for all those who work so hard to try and make these schemes a success and whose money and efforts could be better spent on other improvements.

Recommendations

In order for the River Axe at Weycroft Bridge to achieve its full potential as a good quality habitat for resident brown trout, sea trout and salmon, the following actions are recommended:

1. A number of opportunities exist to improve the abundance and diversity of cover/refuge habitat by introducing some secured woody debris habitat. Considering the often high-energy flow of the River Axe, it is recommended that a number cabled tree 'kickers' are introduced (http://www.wildtrout.org/content/how-videos#tree kicker).

   The first opportunity is about half way along the reach parallel to the A345. A large branch could be dropped into the river and tethered to the base of the tree by a braided steel cable to form a kicker (Figures 9 and 10). Care should be taken to retain the existing in-channel structure.

Figure 9: An opportunity to increase cover habitat by cutting a limb from a bankside tree to create a cabled 'kicker'.

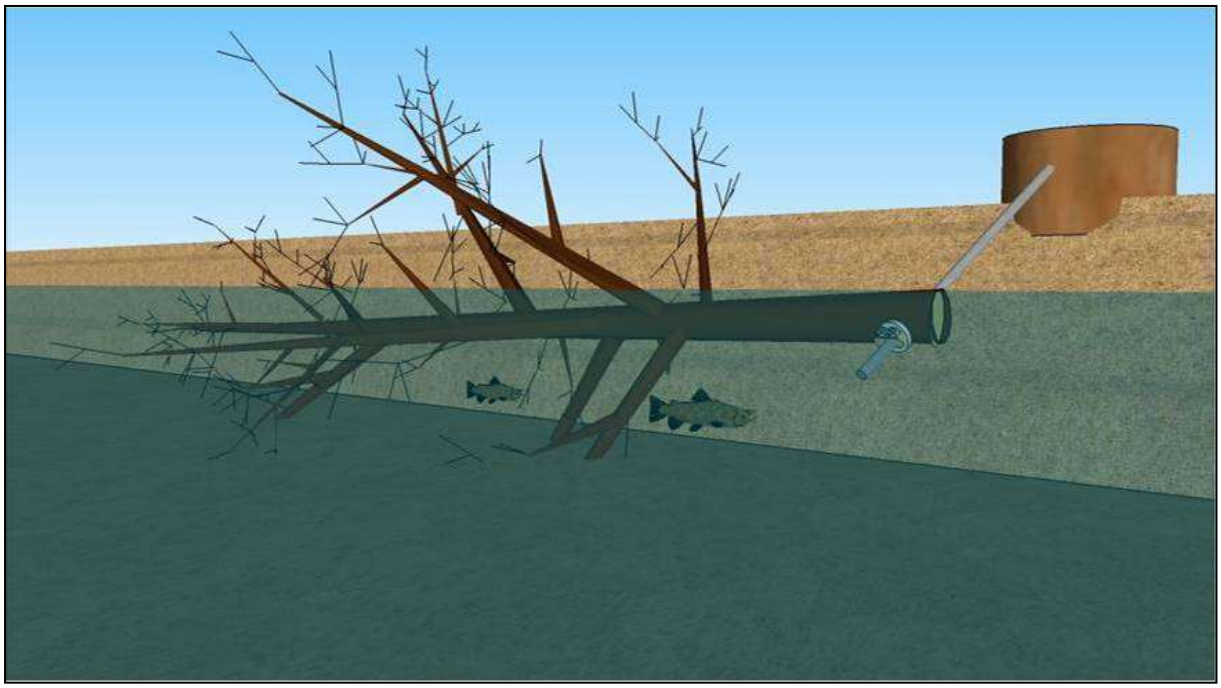

Figure 10: An illustration of a marginal kicker cabled to an existing tree stump

The kicker will provide valuable cover for fish and food/habitat for freshwater invertebrates without increasing flood risk. During high flows the kicker will be swept against the bank and out of the strongest current. The cable also allows the wood to rise and fall with changing water levels (Figure 11).

Figure 11: An example of a marginal kicker during high flows

At the bend where the river turns away from the road, another kicker could be won from a small stand of alder (*Alnus glutinosa*) (Figure 12) without significantly reducing the overall tree cover at this location.

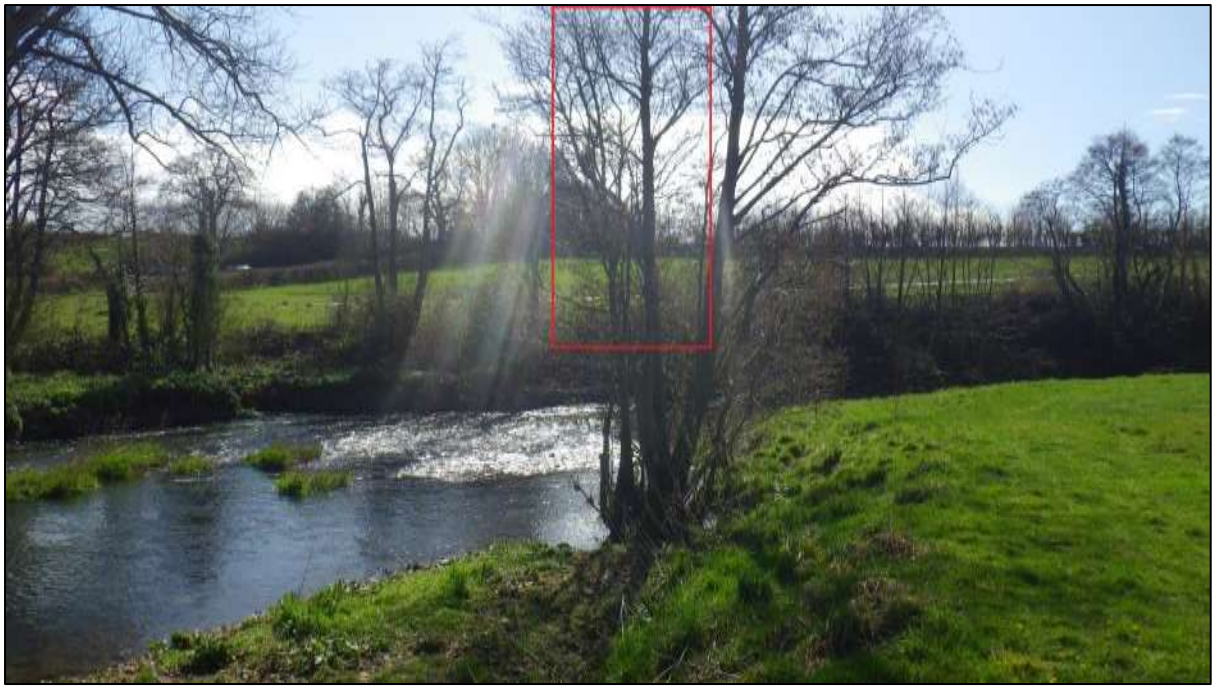

Figure 12: **Another kicker could be won from a small stand of alder (section denoted by red box)**

Although one of the stems sourced from the alder stand would make an ideal kicker, the inside of the bend may not be the best location for it to be installed. Instead, this kicker could be cabled to one of the large trees

to provide some additional cover over the deep run on the opposite bank (Figure 13).

Figure 13: A good location for another kicker (position denoted by red box)

2. Tree works to improve access for fishing and diversify light conditions on the LB of the reach towards the railway bridge (Figures6 and 7) would give rise to material that could be used to introduce additional cover and improve flow diversity (http://www.wildtrout.org/content/how-videos#tree). By felling a couple of trees into the margin facing downstream and securing them with reinforcing bars (http://www.wildtrout.org/content/how-videos#log) and cable, a degree of flow deflection would be introduced that should scour the bed and introduce greater diversity of depth (See example Figures14 and 15).

Figure 14: A large tree felled into the margins of the River Monnow near Abergavenny

Figure 15: The base of the tree is secured by reinforcing bars driven through drilled holes and braided steel cable.

3. Areas where excessive erosion is deemed to be a problem, such as that highlighted in Figure 2 (page 6) can be treated with brushwood won from on-site tree works. These could be used in combination with live willow to stabilise the bank (see example Figures16 and 17). Densely-packed brushwood is very effective at absorbing energy from the flow and locally slowing water velocity. This not only protects the bank, but the reduction

in flow energy also often leads to deposition of sediment within the structure, effectively rebuilding the bank. Live willow 'whips' (thin, straight sections) and live willow stakes driven into the bank will, if successfully planted, continue to grow and strengthen with time. Willow whips and stakes can probably be won from existing bankside willows.

Figure 16: A brushwood bank protection revetment being installed on a spate river

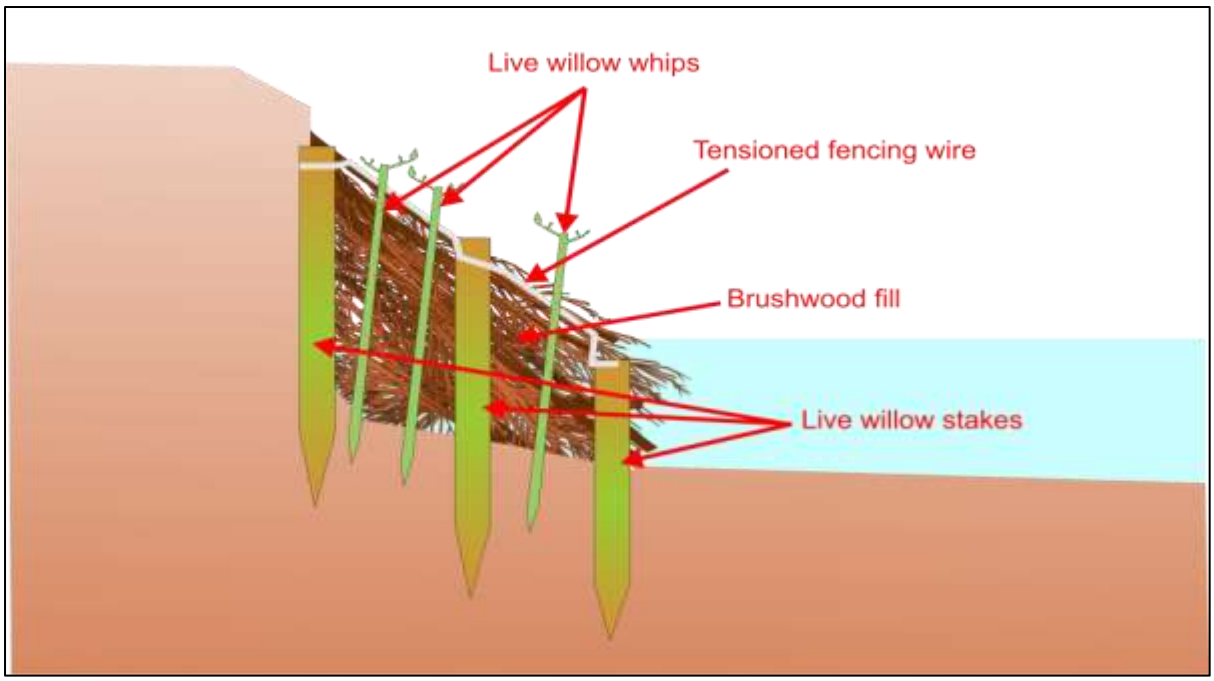

Figure 17: A cross section illustration of a brushwood erosion protection installation with live willow

Willow can be cut and planted at any time of year but the technique is most successful if undertaken in winter or early spring when the willow is still dormant.

Making it Happen

The creation of any structures within the river or with 8m either side will require formal Flood Defence Consent (FDC) from the EA. An FDC application will have to be submitted to the EA, usually along with a methodology and drawings detailing the proposed works. This enables the EA to assess not only possible flood risk, but also any possible ecological impacts. Contacting the EA early and informally discussing any proposed works is recommended as a means of efficiently processing an FDC application.

The WTT website library has a wide range of free materials in video and PDF format on habitat management and improvement:

http://www.wildtrout.org/content/index

The Wild Trout Trust has also produced a 70 minute DVD called 'Rivers: Working for Wild Trout' which graphically illustrates the challenges of managing river habitat for wild trout, with examples of good and poor habitat and practical demonstrations of habitat improvement. Additional sections of film cover key topics in greater depth, such as woody debris, enhancing fish stocks and managing invasive species.

The DVD is available to buy for £10.00 from our website shop http://www.wildtrout.org/product/rivers-working-wild-trout-dvd-0 or by calling the WTT office on 02392 570985.

There is also the possibility that the WTT could help via a Practical Visit (PV). PV's typically comprise a 1-3 day visit where WTT Conservation Officers will complete a demonstration plot on the site to be restored.

This enables recipients to obtain on the ground training regarding the appropriate use of conservation techniques and materials, including Health &

Safety, equipment and requirements. This will then give projects the strongest possible start leading to successful completion of aims and objectives.

Recipients will be expected to cover travel and accommodation (if required) expenses of the WTT PV leader.

There is currently a big demand for practical assistance and the WTT has to prioritise exactly where it can deploy its limited resources. The Trust is always available to provide free advice and help to organisations and landowners through guidance and linking them up with others that have had experience in improving river habitat.

Disclaimer

This report is produced for guidance; 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 guidance made in this report.