Advisory Visit

River Petteril, Cumbria

8th February, 2010

1.0 Introduction

This report is the output of site visits undertaken by Tim Jacklin of the Wild Trout Trust to the River Petteril, on 8th February, 2010. Comments in this report are based on observations on the day of the site visit and discussions with Alison Reed and Will Cleasby of Eden Rivers Trust.

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 Overview

The River Petteril is a tributary of the River Eden in Cumbria. Eden Rivers Trust (ERT) has identified the Petteril sub-catchment as one of the most degraded within the Eden catchment, facing issues such as:

- high to very high risk of receiving diffuse pollution, as predicted by environmental models;
- high levels of riparian damage and little bankside cover due to intensive grazing (over 19km of banks are impacted by stock poaching);
- runoff from the M6 motorway;
- the urban expansion of Carlisle; and
- poor juvenile trout numbers and no juvenile salmon, as evidenced by electrofishing surveys.

Comprehensive information on the catchment can be found in the sub-catchment conservation plan at http://trust.edenriverstrust.org.uk/images/stories/subcatchments/river%20petteril%20conservation%20plan%2004_07.pdf .

Three sites were visited to investigate options for in-stream habitat improvement works, which could be carried out alongside riparian habitat improvements such as fencing and changes to land management.

3.0 Site Visits

Site 1: Wreay Woods Nature Reserve

This site (National Grid Reference NY443500) is owned by Cumbria Wildlife Trust (CWT). The river here is located in a steep-sided, wooded valley which is managed as a nature reserve. There is a footpath along the right bank, and the wildlife trust has carried out some tree management by felling sycamores and encouraging native tree species, such as alders and hazel.

There is a very sandy, friable soil here which is not particularly resistant to erosion, a fact exacerbated by the absence of dense low bankside vegetation at this shaded site. These factors have created a river channel which is generally wide and shallow, dominated by riffle and shallow glide habitats, with few deeper pools which provide good habitat for adult fish (Photos 1, 2). The river bed substrate is poorly sorted and contains a high proportion of fine particles (sand), which mitigates against successful salmonid spawning (Photo 1).

The erosion resulting from the friable soils, tree shading and flashy flow of the river means there is an active recruitment of large woody debris (LWD) to the river (Photo 3). Any wood that falls into the river is left *in situ* by CWT, and as a result there are some very good examples of natural LWD (Photo 4). The presence of LWD within rivers has been shown to be important for a number of reasons, including:

- Creating a diversity of flow patterns which in turn cause localised scour and deposition, promoting diversity in the shape of the river channel and hence habitats;
- Promoting the sorting of bed substrate which makes the right-sized spawning gravel available for trout, salmon, lampreys, bullhead and other gravel-spawning species;
- Retaining leaf litter and other organic matter which supports shredding invertebrate species and the species which predate upon them (including trout);
- Providing refuge habitat for white-clawed crayfish, a nationally threatened BAP species;

- On a catchment scale, checking the flow of water and reducing downstream flood risk.

There are ample opportunities for easily introducing LWD in this section of the Petteril. There are numerous hazel trees which could be nicked and hinged into the river to provide low marginal cover for juvenile trout, mimicking similar natural structures (Photo 7). Larger LWD structures could be introduced using tree trunks and rootballs, with various methods of anchoring (see recommendations section).

During the visit the feasibility of positioning LWD to protect eroding banks was discussed. There were two areas where erosion was threatening the route of the existing footpath. One area (Photo 8) could be tackled by packing brushwood into the scalloped areas between trees, and would slow the rate of erosion here; however, it is unlikely that the bank would consolidate and vegetate because of the shading of the woodland. The second area is an earth cliff where trees have recently fallen into the river (Photo 3). It is unlikely that attempting to protect this bank would be successful or worth the considerable effort involved, as floods will undoubtedly continue to erode the outside of this bend. Whilst such erosion is inconvenient in that it affects the footpath, it is not a ‘bad thing’ for the river ecology in this context. It could be argued that the erosion is of greater severity through more frequent and larger spates because of upstream land use and drainage, but tackling the causes rather than the symptoms would be the way forward here.

Photo 1 Wide, shallow river channel with a high proportion of fine sediment in the bed substrate

Photo 2 The reach is dominated by shallow riffle and glide habitat

Photo 3 LWD is being actively recruited to the river channel within this reach

Photo 4 There are some good examples of mature LWD illustrating the effects on channel shape, dimensions and bed load sorting

Photo 5 There are ample opportunities in this reach for 'hinging' smaller trees....

Photo 6 ....and fixing larger trees into the channel.

Photo 7 Low marginal cover – great for juvenile trout

Photo 8 Bank erosion affecting the route of the footpath

Site 2: Petterilside Farm

This site is located upstream of the bridge at NY 46218 42722, up to the footbridge at NY 46829 42457. The landowner, Robert Harris, and farm manager, James Turner, were present during the visit. The site has two tenant farmers, and is fished by Penrith Angling Association. Some tree coppicing works and fencing are planned by Penrith AA and ERT, and it may be possible to use some of the timber arising from this to introduce LWD to the river channel.

The river here has a good pool and riffle structure. There are a moderate number of trees alongside the river, chiefly on the right bank which is steep and wooded in the middle of the section. Shading by trees is relatively light along this reach, and stands of water crowfoot (*Ranunculus* sp.) are present in shallow, faster-flowing areas. The left bank is lightly grazed although limited areas show signs of poaching where livestock are congregating.

Some areas of the bank have been reinforced with boulders, which may have been sourced from the river channel (Photo 11). It would be beneficial to place some of these in shallow glide habitats downstream of riffles to provide shelter for juvenile trout and help increase the river's carrying capacity for this life stage.

There are opportunities to introduce LWD by:

- hinging smaller trees over into the river to provide marginal cover for juveniles (Photo 12)
- hinging well-placed larger trees to create larger LWD structures that will promote scour, depth variation and sorting of the bed substrate (Photo 13)
- Fixing tree trunks arising from coppicing to the river bed to form flow deflectors/groynes. Tree root balls with some trunk still attached would be even better for this purpose but would likely have to be imported to the site.

Some fallen trees have previously been removed from this section which could have been managed to create beneficial LWD structure (Photo 14).

The presence of a road bridge at the downstream end of this reach means it would be advisable to make LWD structures from pieces of timber which

would not block the bridge in the event of them coming loose in floods. Alternatively a failsafe anchor needs to be used to ensure the LWD does not move out of position; this could be a deadman anchor fixed into the bank, or to a tree stump (see Recommendations section).

Photo 9 River Petteril at Petterilside Farm

Photo 10 Localised bank poaching by livestock

Photo 11 Boulders reinforced banks – perhaps some of these could be used within the channel once the banks are fenced?

Photo 12 Small trees on the far bank could be partially cut and hinged over to provide low cover

Photo 13 Leaning trees like this could be hinged and trimmed to create stable LWD structures; this would also preserve the root ball within the bank.

Photo 14 Leaving more of the trunk on this fallen tree could have created a good LWD structure on this riffle

Site 3: Laithes – Newton Reigny

This site is located between the above villages at approximate grid references NY 46965 32770 and NY 47685 32025. The site is not fished, although it would make a good addition to the ERT Go Wild fishing passport scheme. In the field at the upstream end of the reach, the river channel was open and treeless, and the banks had been extensively reinforced with rip-rap consisting of stone and building waste (Photo 15). A small tributary on the LHB was suffering from excessive bank poaching and is a source of fine sediment entering the river (Photo 16).

Further downstream the land use is less intensive, particularly on the LHB where there is a wide zone of lightly-grazed, wet ground (Photo 17). Riparian trees are more prolific, the majority being alders. The right bank is grazed (by alpacas at the time of the visit!) and is not fenced; the grazing is relatively light although there are one or two areas of light poaching where stock drink or cross the river.

The in-stream habitat on this reach is good, with a well-developed pool and riffle sequence, shingle point bars and mid-channel shoals (Photo 18), a good balance of light and shade, the presence of water crowfoot and some good examples of LWD (Photo 19).

Further LWD structures could easily be introduced to this reach by hinging selected trees and/or pinning logs to the river bed. This could be achieved by a two-person team in a day, although the effort may be better targeted at other stretches of the Petteril given the relatively good habitat at this site.

Photo 15 Open banks heavily reinforced with rip-rap

Photo 16 Heavy poaching alongside the small tributary on the LHB

Photo 17 Low intensity land use on the LHB on the middle section

Photo 18 Mid-channel shoals

Photo 19 Natural LWD

4.0 Recommendations

The options for introducing LWD are many and varied and some ideas are outlined below, along with an indication of which site each technique is suitable for. There are two basic aims when introducing LWD:

1. to improve habitat simply by increasing the amount of LWD present (more refuge habitat, leaf litter retention, etc.);
2. to alter the flow and change the physical shape of the channel (by scour and deposition), thus improving the habitat.

These aims are not mutually exclusive, but different techniques are more suited to these different aims. The latter aim should be carefully considered on the Petteril given the sandy, friable soils of the catchment – these will be vulnerable to bank erosion from improperly positioned LWD intended to cause bed scour.

<u>Hinging small trees</u>

Small trees such as hazel, and young ash and alders can be partially cut through at the base and pushed over so they lay parallel to the water surface, similar to hedge-laying. The trees should be laid along the bank to provide low cover, and minimal resistance to high flows. Suitable for all sites, and compatible with aim 1 above.

Photo 20 Hinged tree

Tree ‘sweepers’ or ‘kickers’

These are generally larger trees with a dense branch network which are positioned parallel to the bank and provide excellent cover for invertebrates and fish (Figure 1). They can be created by hinging larger trees which are in a suitable position, or by cutting trees and cabling them to their stumps, or by felling trees some distance from the river so they fall with their crowns hanging into the water.

When hinging larger trees, especially leaning trees, careful use of a chainsaw is required by qualified and competent persons, otherwise serious injury or death can result.

Dense evergreens are the best tree species for this type of structure (the technique was developed in North America), which are usually lacking alongside British rivers; broad-leaved species can be used but do not provide the same degree of cover and habitat. This technique is compatible with aim 1 above, although accumulations of fine sediment can occur around these structures, altering the dimensions of the channel cross-section.

These structures would be suitable for all sites inspected on the Petterill.

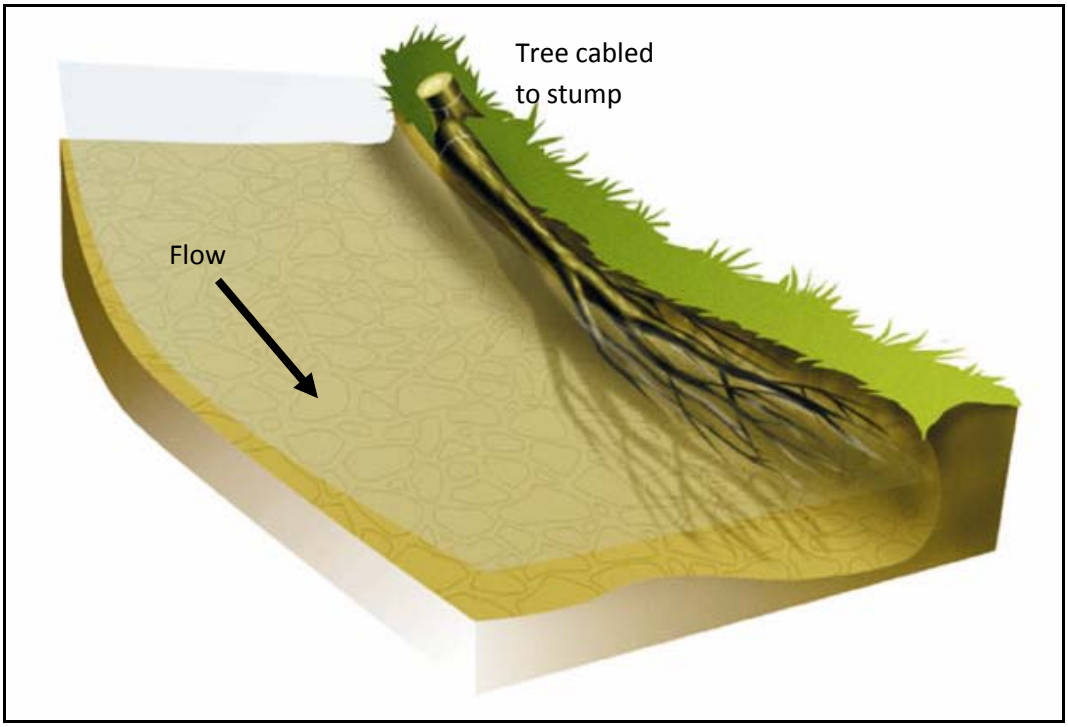

Figure 1 Tree sweeper or kicker

Flow deflectors and groynes

These are generally constructed from large lumps of wood such as tree trunks and root wads. The aim of these structures is to alter flow and change channel dimensions, although root wads can directly provide good refuge habitat for invertebrates and fish. The structures are usually positioned across the flow to some degree, and generally pointing in an upstream direction to deflect high flows away from banks (Figure 2).

These structures need to be very firmly fixed. Leaving trees hinged or cabled to their stumps is a possibility on steeper banks (Figure 3). Embedding a good proportion of the LWD into the bank, and / or using a deadman anchor would be necessary on lower gradient banks – heavy machinery would be required for this (Figure 4).

These structures would be suited to the Wreay Woods site and the Petterilside Farm site. At the former site, the fixing shown in Figure 3 would have to be used because of limited access for heavy machinery. At the latter site, structures similar to those in Figure 4 are possible, positioned on the LHB nearer the upstream end of the site, where excavation and machinery access is possible.

Note that for all structures 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.

It may also be necessary to consult Natural England if any of the works fall within designated conservation sites. Care should also be taken to evaluate and minimise any potential damage that works may cause to protected species such as bats, white-clawed crayfish, water voles, etc.

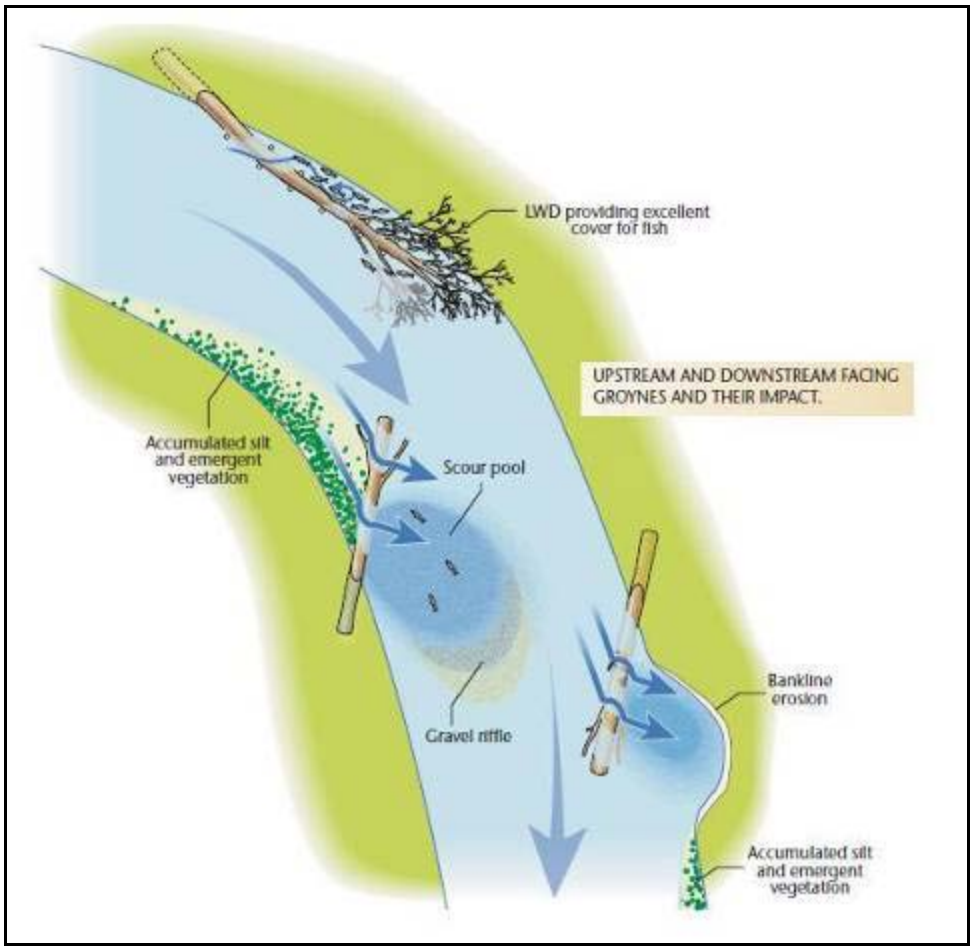

Figure 2

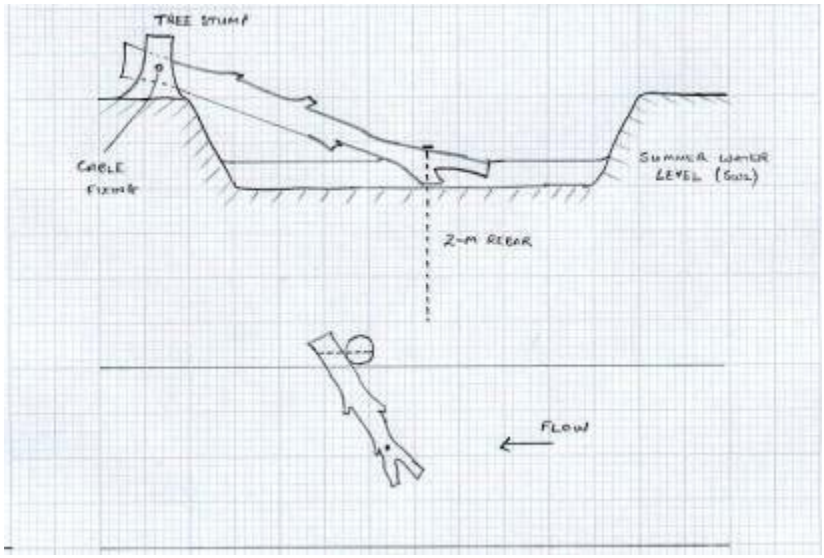

Figure 3

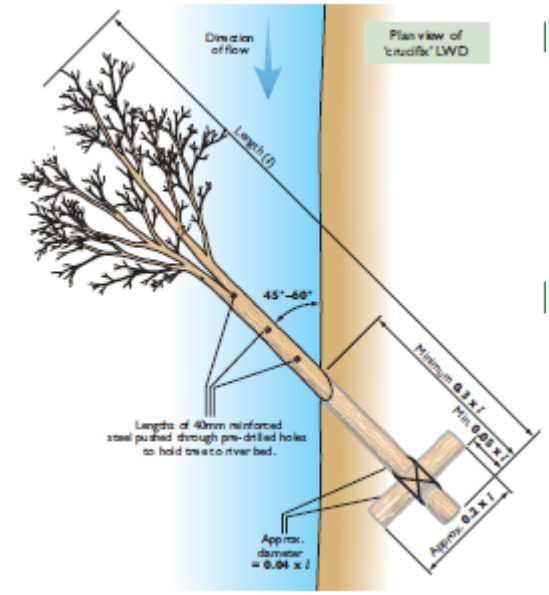

Figure 4

General principles of fixing upstream pointing deflector. Main piece of LWD can be a tree (as shown), tree trunk, or root wad with trunk attached (From STREAM project, www.streamlife.org.uk).

5.0 Making it Happen

The Wild Trout Trust are able to assist in carrying out the above recommendations by providing Eden Rivers Trust and local angling interests with support to prepare detailed project proposals, obtain the relevant consents and demonstrate practical works via the WTT Practical Visit service. Please contact Tim Jacklin for further details.

6.0 Acknowledgement

The Wild Trout Trust would like to thank Eden Rivers Trust and the Association of Rivers Trusts for the support which made this visit possible.

7.0 Disclaimer