Advisory Visit

Skitwath Beck – River Eden Catchment

9th March 2016

1.0 Introduction

This report is the output of a site visit to Skitwath Beck and a short section of a tributary, which are themselves upper tributaries of Dacre Beck and the River Eamont – River Eden Catchment, at the request of the Danny Teasdale. The purpose of the visit was to assess habitat quality on the Beck and make recommendations for improvements that could be undertaken.

Normal convention is applied throughout this report with respect to bank identification, i.e. the banks are designated left bank (LB) or right bank (RB) whilst looking downstream. Upstream and downstream references are often abbreviated to u/s and d/s, respectively, for convenience. The Ordnance Survey National Grid Reference system is used for identifying locations.

2.0 Catchment Overview

Bedrock geology in the Skitwath Beck catchment u/s of the site visited comprises mainly limestone; however, around the site, sandstone, siltstone and mudstone also become prominent with superficial deposits of alluvium (sand silt clay and gravel) present throughout. The limestone influence of the upper catchment increases the productivity of the watercourse over some of the other River Eamont tributaries, particularly those draining the fells into Ullswater. This can be observed in the relatively rich diversity of aquatic macrophytes inhabiting areas of the Beck.

As with many becks around the country, Skitwath Beck has been subjected to significant dredging and realignment over the years and this has greatly affected its character, degrading the habitat it provides. Fortunately, a more recent trend to move away from channel maintenance for purely water conveyance purposes has allowed some recovery of the geomorphology and habitat quality of the Beck. Hard engineering of the banks is somewhat hindering further natural channel recovery.

Under the current Water Framework Directive (WFD) classification (2015), this waterbody achieves a 'Good' status, being 'Good', 'High' or 'Supports good' for all parameters assessed. However, this fails to identify the significant impact of past channel maintenance, certainly upon the site visited, and the limiting effect that is likely to have on the potential of its fish stocks. It may be that the sample sites upon which the waterbody is assessed are in higher quality areas or that the standards against which the parameters are assessed are lower than the Beck's potential.

The WFD assessments (usually via spot-check data collection) also fail to identify the history of water quality issues on the Beck, several of which have resulted in major fish-kills, the most recent being in 2015. Water quality sondes (probes) are now in place on the Beck to try and identify

these regular events more effectively and, hopefully, lead to their prevention.

	2009 Cycle 1	2015 Cycle 2	Objectives
Overall Water Body	Good	Good	Good by 2015
Ecological	Good	Good	Good by 2015
Biological quality elements	Good	Good	Good by 2015
Fish	Good	-	-
Invertebrates	-	Good	Good by 2015
Macrophytes	-	-	-
Macrophytes and Phytobenthos Combined	-	High	Good by 2015
Hydromorphological Supporting Elements	Supports good	Supports good	Supports good by 2015
Hydrological Regime	High	High	Supports good by 2015
Morphology	Supports good	Supports good	-
Physico-chemical quality elements	High	Good	Good by 2015
Specific pollutants	High	-	Not assessed
Chemical	Does not require assessment	Good	Good by 2015
Other Pollutants	Does not require assessment	Does not require assessment	Does not require assessment
Priority hazardous substances	Does not require assessment	Does not require assessment	Does not require assessment
Priority substances	Does not require assessment	Does not require assessment	Does not require assessment

Table 1. Water Framework Directive status for Skitwath Beck (http://environment.data.gov.uk/catchment-planning/WaterBody/GB102076070970).

3.0 Habitat Assessment

3.1 Skitwath Beck

The relative uniformity and low sinuosity of the channel is immediately apparent on the Beck, as is the hard bank revetment that has been installed to try and keep the channel entrained, although fortunately, some of the revetment is now beginning to fail (Fig. 1). While this area of the Beck is within a steep sided valley and so would naturally be less sinuous than a lowland watercourse, the straightening and dredging has accentuated this factor, producing a channel with elongated pools and riffles and a reduced number of those features. The lack of sharp bends also limits the depth that pools can achieve, with many areas between riffles forming little more than deep glide habitat (Figs. 1 & 2). The lack of flow energy dissipation within

the relatively uniform depth, width and planform of the channel also reduces the amount of finer substrate that can be retained, with smaller gravel in short supply.

Figure 1. Straightened channel section, the lack of sinuosity and sharp bends leads to a lack of discrete areas of bed scouring and a lack of deeper pool habitat.

Much of the Beck is buffer fenced allowing beneficial rank grasses and herbaceous vegetation, as well as planted and self-set shrubs to become established. These will greatly increase the stability of the banks above that of grazed areas and provide vital habitat along the banks and within the river margin (Fig. 2). By preventing livestock access to the banks, the associated reduction in soil compaction will also increase water filtration into the soil and help to intercept surface run-off, forming additional protection against siltation and nutrient input to the Beck.

Figure 2. Buffer fences support the development of healthy bankside vegetation and improve habitat quality.

Another issue with the dredging of a watercourse is evident in the level of channel incision which occurs, lowering the current river bed well below that of its original condition. This factor is well-demonstrated in Figure 3 where straightening of the channel has resulted in the bed level over a metre below that of the relict channel, which now forms a perched pond. A long-term aspiration for this area should be to reinstate the old channel, thereby greatly reducing the gradient of the reach and facilitating the retention of finer substrate.

Similarly, the next reach d/s presents an ideal opportunity for assisted natural channel recovery where, if the hard bank revetments are removed, the Beck could be allowed to develop more sinuosity naturally, or with assistance from some simple in-channel structures.

Tree felling work underway in the area by Eden Rivers Trust (ERT) to remove the coniferous trees also highlights an additional action that could be undertaken, utilising the tree materials won. Pinning the conifer tips across the watercourse would help to slow flows d/s by increasing the transition time through the site. This would dissipate flow energy locally, helping to retain finer substrate and is also a technique that, when undertaken at a catchment-scale, has been shown to reduce peak flood events d/s. The additional in-structure and areas of lower flow also provides excellent habitat for invertebrates.

Figure 3. The Beck (left of shot) and relict channel that forms a pond (right of shot) with the addition of water from a smaller side tributary.

Figure 4. Possible site for assisted river restoration by removal of the hard bank revetment (schematic representation of proposed new channel course in red).

In areas where the gradient is lower and the channel wider, areas of gravels were present and provide some salmonid spawning habitat. The material is still quite large in diameter and therefore better suited to large resident trout and migratory salmonids. Increasing the occurrence of finer gravels would be greatly beneficial for smaller resident trout spawning. It should also be noted that in many areas the coarse substrate present is the product of natural sediment transport post cessation of dredging as, in many areas, the bed was regularly dredged right down to clay (D Teasdale 2016, pers. comm., 9 March). This highlights the potential for further natural recovery with material supplied from u/s if the channel morphology and can be improved.

Figure 5. Where gravel is present it tends to be on the larger side of what resident trout can utilise.

Beneficial improvements to in-channel habitat quality have already been undertaken on the Beck, employing small brash/kicker type techniques and willow laying and additional work in this vein will be greatly beneficial alongside any more significant channel improvements (Fig. 6). These provide valuable flow dissipation that increases sediment deposition in their lee, along with valuable cover for fish.

Being outside the influence of grazing, bankside and emergent vegetation encroaching into the channel provides natural improvements in width variation, with the narrower channel creating discrete areas of accelerated flow, driving bed scour to maintain deeper water refuge (Fig. 7). Narrower areas also help to retain depth in low flow conditions.

Figure 6. Simple in-channel habitat improvement techniques provide valuable dissipation of flow energy and provide additional cover.

Figure 7. Natural channel narrowing facilitating some bed scouring and creating deeper water habitat.

About 2/3rds of the way along the length visited, Swinescale Beck joins and with the increased flow, a slightly larger pool has formed with good cover provided by bankside willows and undercut banks (Fig. 8). At the d/s end of this pool, a pinch point at small footbridge that accelerates flows, creating another wider, although not particularly deep pool in which some finer substrate is retained.

Figure 8. The confluence of the Swinescale Beck and Skitwath Beck provides some deeper water refuge and overhanging cover.

Proceeding d/s of the pool, the character of the Swinescale Beck changes markedly, with the channel becoming noticeably larger and supporting a far greater extent of deeper pool habitat, capable of supporting a healthy population of adult resident trout (Figs. 9, 10 & 11). Bankside willows help protect the bank and provide high quality cover and refuge for fish from high flows and predators (Fig. 9).

Figure 10 depicts good pool habitat but with a lack of tree cover (as in Fig. 11) which is likely a partial cause of the bank erosion that has now undermined the fence. Setting the fence line back a few metres would allow the bank to revegetate and facilitate planting of willow that will help to bind the bank together and reduce the rate of erosion. The added cover then provided would also enhance the habitat quality of the pool.

Figure 9. Excellent overhanging and trailing willow cover over deeper pool habitat.

Figure 10. Deeper pool habitat with eroding, undercut bank.

Immediately d/s, a straight pool again provides some good deep water habitat but is lacking in aerial cover (Fig. 11). Interestingly, the fixed bed level d/s (the u/s extent of the A66 road crossing structure) is likely to be retaining some of the depth within the straight pool but causes its own additional issue through the impediment to fish passage created by the shallow flows over a smooth concrete bed (Fig. 12). It is understood that rectifying the issue of fish passage at the A66 road crossing is being looked into by the council's highways department and ERT. Depending upon how far u/s along the concrete bed the easements are installed, additional improvement may be possible through willow planting to provide additional shrubs that could be laid into the channel to dissipate flows and provide resting areas that will assist fish past the section.

Figure 11. Straight but reasonably high quality pool habitat though lacking tree/aerial cover.

Figure 12. Shallow water and fast flows over concrete-lined channel (part of the A66 road crossing structure) creates an impediment to fish passage. Laying more of the willows into the channel and planting more to be laid in future could assist fish passage.

3.2 Swinescale Beck

A short section of Swinescale Beck was walked u/s from its confluence with Skitwath Beck. In this section it became apparent that Swinescale Beck carried a higher fine sediment loading than Skitwath Beck, as evident by the silt deposition on the bed (Fig. 13). It was thought that this is due, at least in part, to forestry practices u/s (D Teasdale 2016, pers. comm., 9 March), although the presence of any unfenced, grazed sections of the Beck u/s could also contribute.

As with Skitwath Beck, much of the channel is artificially straight and revetted, limiting the development of natural geomorphological features, although some smaller resident trout habitat (Fig. 13) and good juvenile habitat (Fig. 14) is present. The hard nature of the armoured banks does limit the availability of cover and refuge, however, as bankside shrub and vegetation growth is limited in those areas (Fig. 13).

Figure 13. Some deeper pool habitat suitable for smaller resident trout is available on Swinescale Beck but deeper, slower areas facilitate deposition of fine sediment indicating issues from input u/s.

Figure 14. Good juvenile salmonid habitat on Swinescale Beck.

A suitably oversize culvert provides farm access over the Beck and nicely demonstrates the issue of sediment transport on straightened and over-wide watercourses (Fig. 15). Owing to the straightened, steepened nature of the realigned channel u/s, much of the smaller substrate is being washed through the section, with little retained. This material is then deposited within the channel where it becomes overly wide at the d/s side of the culvert. As this deposition posed no real issue for flood risk it is recommended that it is retained in place as valuable substrate.

Figure 15. Over-wide culvert has facilitated retention of much of the gravel and cobble substrate that cannot be retained within the straight, steep channel u/s.

Directly u/s of the culvert, deeper water pool habitat could be enhanced as by planting willows at the water's edge (Fig. 16). In most cases, goat willow (*Salix* caprea) will work best, being a smaller shrub species. Crack willow can also work well as it is a fast-growing species which collapses under its own weight and provides a natural input of woody material to the channel; however, the fast growth means that it may require additional maintenance and so be unsuitable in some locations. Once established, laying some of those shrubs into the channel would further enhance the cover habitat and may also assist in retention of natural substrate in at least some areas of the smooth concrete bed. Planting of willows on alternating banks through the straightened section u/s to push the flow from one bank to the other would also be beneficial (Fig. 17). As on Skitwath Beck, planting and laying of willows along the concrete-lined section, around the A66 road crossing, would also assist fish passage (Fig. 18).

Figure 16. Pool habitat over a smooth concrete bed. Increasing cover with bankside tree planting would be beneficial.

Figure 17. Planting trees alternately along each bank could help to diversify flow in the straightened section once they have grown up and been laid in.

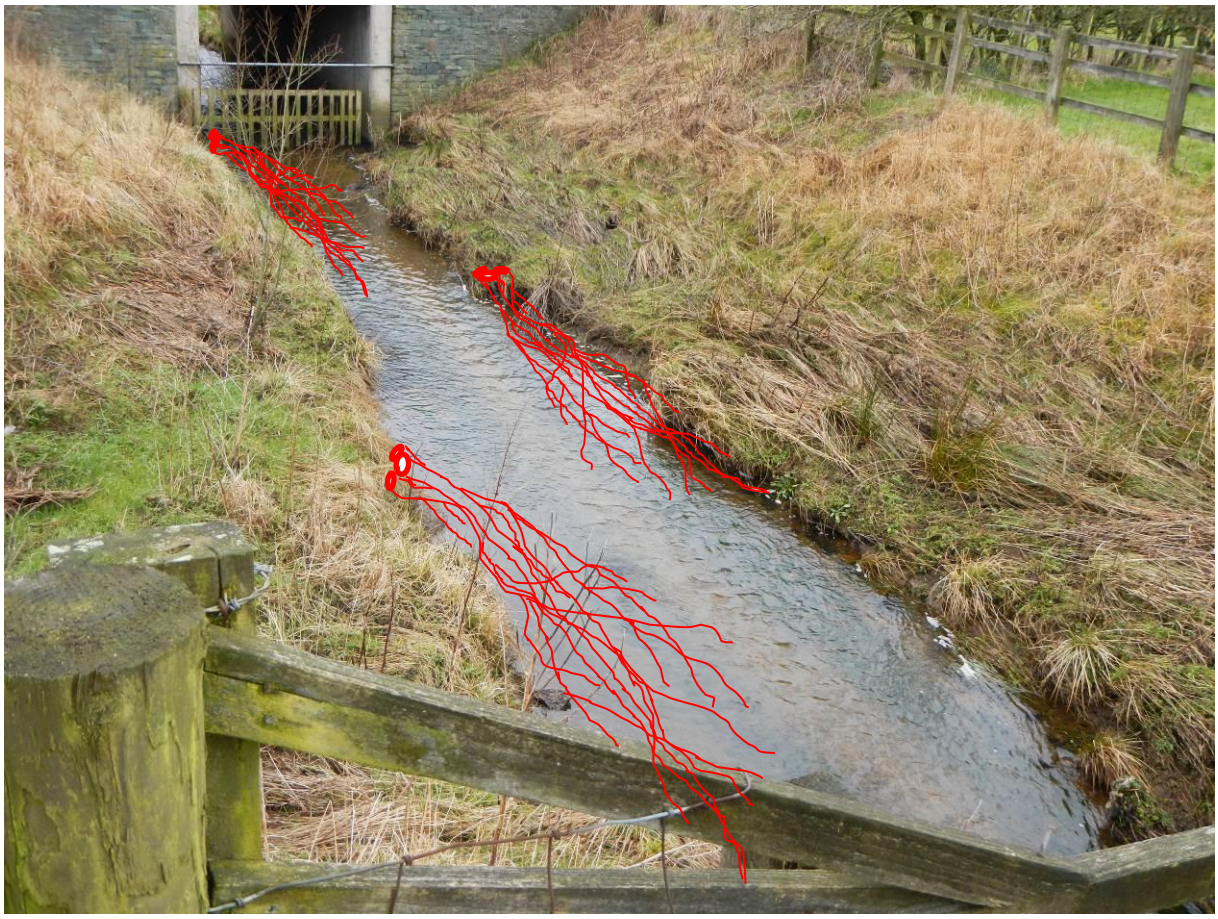

Figure 18. As on Skitwath Beck, bankside trees planted and laid into the channel (red) could help to dissipate flows and assist fish passage.

4.0 Recommendations

There are a range of possible recommendations covering both watercourses inspected but they all generally entail reinstating the channels to as near natural states as is possible and employing light touch techniques that work with the becks' natural processes where appropriate.

4.1 River restoration

It would be greatly beneficial to re-meander the beck channels and reinstate a more natural gradient, planform and geomorphology to the reaches inspected. Wherever adjacent land use allows, bank revetments should be removed, allowing natural erosion to reinstate a more sinuous channel with a greater diversity of width and depth. This is particularly true in the area of the first conifer plantation (Fig. 4). In this area, it may be beneficial to place some of the boulders (or woody material deflectors) in locations within the channel that will help to divert flows into the banks and / or, possibly, undertake some light touch excavation to encourage the Beck into its new course.

Long-term, it would also be beneficial to look at the possibility of reinstating the meander that was lost through straightening (Fig. 3). However,

reinstating this section will ideally require utilisation of some of the adjacent field at the u/s end.

These may be aspects that ERT can build into their River Restoration Strategy and also something that the Wild Trout Trust can provide advice and support with.

4.2 Tree planting and laying

Planting a mix of native, deciduous tree species would be beneficial in any areas where the channel is lacking cover and can also be used to help increase bank stability in areas of erosion. Smaller shrub willow species would be particularly beneficial on straight sections where they can be laid in to increase flow diversity.

Where willows are already established along the banks, it is recommended that some of the limbs are laid into the channel to increase habitat diversity and provide cover and refuge areas. The structure within the channel should also help to retain finer sediment in areas and, in this vein, willows can be laid alongside the hard bank revetments to dissipate flow energy in areas of bank that still require protection.

4.3 Barriers to fish movement

It is important to address all barriers to fish movement as far as is practicable, no matter what the size or extent, as all sizes require the ability to migrate both u/s and d/s to make use of different habitats. For this reason, it is recommended that improvements to passage through the culvert/concrete lined sections is supported however possible. It will be important to first identify what the Council and ERT have planned and then, if required, undertake additional measures such as planting and laying willows along the poorly passable channel sections.

4.4 In-channel Woody Material and Flood Attenuation

In a similar manner to what has occurred during the felling of conifers in Figure 4, conifers or other trees could be pinned in place over the Becks in locations where flood water can be encouraged to back up behind them (e.g. where there is no risk to surrounding infrastructure such as fencing). The technique simply involves pinning the trees in place across the channel; however, it is important to ensure that, particularly with conifers, only the d/s facing branches are left attached to the tree. This prevents too great a blockage from occurring, as accumulated debris will be forced underneath as the pressure increases. Owing to their orientation, u/s facing branches tend to get trapped against the bed, accumulating more debris and can create problematic blockages.

It is recommended that any such pinned woody material work is undertaken after removal of the bank revetments, once river restoration measures have been initiated and the channel is starting to migrate towards the intended channel course. It may even be that the woody material can be trimmed or angled in a manner that encourages the re-meandering process.

4.5 Further investigation

It was encouraging to see that the pollution issues and fish-kills on Skitwath Beck have finally been taken seriously and that a water quality sonde has been installed to monitor water quality. In addition to this monitoring, ongoing visual observations of the Beck will be vital, with any peculiarities in the Beck's flows, colour or odour recorded and reported to the Environment Agency's Pollution Hotline (0800 80 70 60). To complement the aforementioned, undertaking of river fly analysis through periodic kick sampling would also be beneficial as part of the Riverfly Partnership initiative. ERT offer support with this and can provide training and possibly equipment for individuals to become set up as samplers.

Consent

It is a legal requirement that prior to undertaking works, either in-channel or within 8 metres of the bank, written Flood Defence Consent (FDC) may be required from the Environment Agency (Main River) or local Council (Ordinary Watercourse).

5.0 Making it Happen

WTT may be able to offer further assistance such as:

- WTT Project Proposal
  - Further to this report, the WTT can devise a more detailed project proposal report. This would usually detail the next steps to take and highlighting specific areas for work, and more detailed explanation of the how it can be done, with the report potentially forming part of a land drainage consent application.
- WTT Practical Visit
  - Where recipients are in need of assistance to carry out the work highlighted in a report, there is the possibility of WTT staff conducting a practical visit. This would consist of 1-3 days work, with a WTT Conservation Officer teaming up with interested parties to demonstrate the habitat improvement techniques. The recipient would be asked to contribute only to reasonable travel and subsistence costs of the WTT Officer. <u>This service is in high demand so not always be possible.</u>
- WTT Fundraising advice
  - Help and advice on how to raise funds for habitat improvement work can be found on the WTT website - www.wildtrout.org/content/project-funding

The WTT officer responsible for fundraising advice is Denise Ashton: dashton@wildtrout.org

In addition, 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

We have 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.

6.0 Disclaimer

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