Advisory Visit

River Eden and Scandal Beck

01/05/2015

1.0 Introduction

This report is the output of a site visit to Kirkby Stephen and District Angling Association's (KSDAA) water on the River Eden, undertaken by Gareth Pedley and Jon Grey of the Wild Trout Trust. Several KSDAA members attended the visit (including Alan Swann who along with Colin Edney, requested the visit). Daniel Brazier (Eden Rivers Trust) and John Garner (Natural England) also attended. This report covers observations and discussions made on the day of the visit.

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.

Table 1. Overview of the waterbody details for the sections of river visited

	Waterbody details Upper Section	**Waterbody details Middle Section**	**Waterbody details Lower Section**
River	Eden (Eastfield Bridge Beat)	Scandal Beck (Beckfoot Beat)	Eden (Ploughlands Beat)
Waterbody Name	Eden Headwaters to Scandal Beck	Scandal Beck	Eden – Scandal Beck to Lyvennet
Waterbody ID	GB102076070590	GB102076070600	GB102076070880
Management Catchment	Eden Upper	Eden Upper	Eden Upper
River Basin District	Solway Tweed	Solway Tweed	Solway Tweed
Current Ecological Quality	**Good** – all aspects 'good' or 'high'	**Moderate** – all aspects 'good' or 'high' other than macrophytes and phytobenthos	**Good** – 'good' or 'high' for all aspects other than fish, which are 'moderate' (this doesn't affect the status as the waterbody is classed as Heavily Modified)
U/S Grid Ref of reach inspected	NY 77321 10029	NY 75886 11081	NY 75749 13348
D/S Grid Ref of reach inspected	NY 77126 10451	NY 76536 11243	NY 75130 13927
Length of river inspected (km)	1	0.75	1.1

(http://environment.data.gov.uk/catchment-planning/WaterBody/GB112069061340)

Under the Water Framework Directive (WFD) classification, the *Eden Headwaters to Scandal Beck* waterbody is good. This suggests that the current state of the biological and chemical parameters are as would be expected with minimal human impact. The *Scandal Beck* waterbody is also classified as 'high or 'good' status for all aspects monitored except for macrophytes and phytobenthos. This suggests that the species diversity or abundance is not what would be expected to be there without human impact. The *Eden from Scandal Beck to Lyvennet* is classified as a Heavily Modified waterbody (HMWB), likely due to past channel modification and realignment. This means that although the classification of fish for this waterbody is only 'moderate', the overall classification of 'good' is not downgraded, as all other aspects are 'good' or 'high'.

N.B. The *Eden Headwaters to Scandal Beck* is not classified as a HMWB despite significant realignment and bank revetment evident during the visit. It may be that the total length of channel modification within the waterbody is not considered to be a high enough percentage for it to be classified as a HMWB.

2.0 Catchment / Fishery Overview

The Eden Valley is distinctive for its gently sloping, or rolling, topography. This is in contrast to the surrounding steep, 'harder' ground of the Pennine escarpment, the limestone country of the Orton & Asby Fells and the eastern flanks of the Lake District. This topography is largely a consequence of the extensive blanket of drift deposits (deposits which result from natural erosion and deposition during the Quaternary period, originally derived from solid rocks) overlying the solid geology of the valley, and the manner in which the streams and rivers have cut through deposits to the bedrock. In a few places there are drift-free hills of bedrock, mainly comprising Penrith Sandstones and limestone (www.naturalareas.naturalengland.org.uk/Science/natural/NAsearch.asp).

Areas of limestone bedrock in the upper Eden catchment, and upper and middle sections of many of the Eden's tributaries cause an increase in pH and greatly improve productivity in the river. The bedrock outcrops also influence the course and form of the river, limiting bed scour in areas and encouraging lateral erosion. Channel maintenance and realignment is another major influence, with long sections of the river having been straightened for land management and drainage purposes. This has impacted upon the form and function of the river, degrading habitat and inhibiting natural geomorphological processes such as scour and deposition.

The predominant land use along the River Eden is sheep grazing with some cattle, and areas of woodland and riverside buffer strips. According to the government's 'Magic' website, the majority of KSDAA water lies within Natural England's Higher Level Stewardship (HLS) target areas (www.magic.gov.uk/MagicMap.aspx). While the current round of HLS has been completed, a new Countryside Stewardship Scheme will come into place in 2016, with applications for the scheme possible in the latter half of 2015. Through the new scheme there is likely to be potential for gaining subsidy payments for lower intensity farming/land management practice, e.g. land placed into buffer strips along the river banks to exclude livestock.

3.0 Habitat Assessment

3.1 Eden – U/S Eastfield Bridge

In the fields upstream of Eastfield Bridge the impact of sheep grazing was immediately apparent (Figure 1). Sheep grazing maintains grass closely cropped to the ground and ensures that other herbaceous vegetation cannot establish (grasses regrow from their base and withstand continual grazing pressure far better than other plants). The impact of this land management has notable implications for the local ecology and riverbank stability.

As only a small amount of vegetation is present above the ground, direct protection of the soil (via interception of precipitation and diffusion of high flows) is limited. In addition, as the grass expends much of its energy replacing the grazed material above the ground it has less energy to place into root growth below the ground. This means that there is less root structure under the ground and the structure is much less diverse than if multiple species with varying root systems (some deep, some extending laterally) were present. Uniformly shallow root systems do very little to reinforce earth banks against erosion. These combined factors make grazed turf highly susceptible to erosion, as evident by the exposed tree roots where areas of topsoil have been lost (Figure 1). This is further compounded by both trampling by livestock and associated washout of material at high flows. (See example in Figure 2 of the root system below a diversely vegetated bank on another river where the roots extend >50cm into the ground, rather than c.15cm with grazing)

Figure 1. Closely cropped grass that provides very little protection and a lack of root structure to support bank stability. Consequently, sheep trampling and high flows have resulted in significant erosion around the trees.

Figure 2. This photograph, taken on another upland river, shows how a well vegetated buffer strip with diverse vegetation provides greatly improved root systems within the bank and greater bank stability/protection. Although erosion does still occur (it's a vital, natural process), the rate and extent is greatly reduced.

Another major issue resulting from sheep grazing is that natural tree regeneration is lost. As with herbaceous vegetation, self-set shrubs and saplings are eaten with the grass before they develop and they cannot withstand continual grazing pressure (unlike grass). For this reason, only mature trees are present along most grazed banks. Subsequently, as mature trees die or are washed into the river, areas of bank become completely devoid of trees due to the lack of natural regeneration. Without tree roots to consolidate a bank it becomes even more susceptible to erosion, resulting in many negative impacts including channel over-widening, increased sedimentation and reduced water depth.

Willows are particularly susceptible grazing pressure as they are highly palatable to livestock (particularly sheep), and as a consequence, they are often the first species to be lost. Due to its affinity for water (it is one of the few species that can actually grow in the river), willow provides great in-channel structure and low-level or trailing cover for fish, often facilitating beneficial sediment deposition and channel narrowing (Figure 3). The structure it provides within the channel is also vital cover in which to evade predators, so its loss from the river is a significant issue.

Figure 3. A fallen willow tree growing within the river channel provides high quality cover and shelter for fish. Willow is one of the few species capable of growing in such conditions so its loss constitutes a great loss of habitat diversity.

Both terrestrial and aquatic invertebrate communities suffer in areas where diverse bankside vegetation is lost for several reasons. Terrestrial invertebrates are impacted by the direct habitat loss as vegetated river margins form important refuge areas for many species, particularly beetles. The loss of trees and of overhanging and trailing vegetation also impacts upon many aquatic species; these utilise marginal structure for access when emerging or returning to lay their eggs and rely upon taller trees as a refuge once they have emerged from the river. Leaf litter from trees and marginal vegetation provides a valuable source of detritus that forms the food source for many aquatic invertebrates. Furthermore, trailing and partially-submerged vegetation all serve to retain that nutritious leaf material during spate flows.

Where present, large woody debris (LWD) and fallen trees within the channel create important habitat features (Figure 4). They provide structure, increasing valuable flow diversity and scouring within the channel that maintains depths, cleans and sorts gravels and deposits finer material elsewhere. Dead wood also provides important habitat for many invertebrate species along with a readily available source of food. For these reasons it is important to maintain LWD to a natural abundance, rather than being tempted to tidy it away.

Figure 5. LWD provides a wide range of benefits, from scour and deposition that benefit trout lies, to structure and food for many invertebrate species. It is very important to maintain and, where absent, reintroduce LWD to the river.

Throughout much of the section upstream of Eastfield Bridge the channel has been modified, with notable areas of bank revetment and steep, tree-lined banks; this, in conjunction with areas of bedrock, often maintains an overly uniform channel width and correspondingly uniform bed profile (Figure 6).

In most areas, at least one bank provides good low-level and trailing tree cover, supporting lies for parr and adult trout; however, the steep, formal nature of the banks appears to be preventing natural narrowing. High flows, contained within the banks and unable to escape onto the floodplain, are likely to mobilise much of the sediment deposited at lower flows. This is another good reason to promote diverse structure within the river margins (LWD and trailing branches) as it will facilitate greater retention of substrate that will, in turn, create greater variation in flows and river bed profile.

In areas, the river is already beginning to narrow naturally within its channel, particularly immediately upstream of the bridge (Figures 7 & 8). However, sheep grazing on both banks is impacting on the process. Grazing of vegetation on the gravel bar on the LB is inhibiting consolidation and stabilisation of the bar (Figure 8) and a watering point on the RB is accelerating erosion and land loss (Figure 7).

Figure 6. Uniformly wide channel section with a correspondingly uniform bed profile. Some good low-level cover is provided by the overhanging trees on the far bank (RB), but increased structure in the LB margin could increase sediment retention that would focus flows down the RB and increase water depth around the fish lies.

Figure 7. Gravel deposition in the near (LB) margin and erosion around a livestock watering point along the far bank.

Figure 8. Looking upstream from Eastfield Bridge, gravel deposition on the true LB (right of shot) is providing some beneficial narrowing. However, heavy sheep grazing is preventing much of the bar from becoming vegetated and increasing the area of the front edge that remains mobile. This prevents further, beneficial narrowing that would otherwise help to maintain greater water depth under the trees along the right bank.

At the upstream side of Eastfield Bridge footings, an outlet from the sewage treatment works was noted. It appeared to be discharging water of a poorer quality than the river; something that would be worth investigating as, although colour and odour are no clear indicator of an issue, they may suggest that the discharge is not meeting the conditions of its consent. In addition, anecdotal evidence from KSDAA members during the site visit suggest that river fly sampling in that area has revealed impoverished invertebrate communities. This is another reason to request that the Environment Agency assesses the discharge.

Downstream of the bridge, a beneficial buffer strip protects the LB and allows a much greater diversity and extent of vegetation. In the absence of grazing, small willows have also become established (Figure 10). Habitat along the right bank is also of a much higher quality as the banks appear to be too steep for the horses in the adjacent field to graze. With the greater bank protection/stability and marginal structure, the river is much narrower and displays a greater diversity of geomorphological features. <u>Much higher habitat quality!</u>

Figure 9. Water discolouration and odour were noted at the sewage works discharge u/s of Eastfield Bridge. This may indicate an issue with the quality of water being discharged to the river.

Figure 10. Downstream of Eastfield Bridge, in the absence of grazing, river banks are more stable, with better cover and a greater diversity of in-channel features.

3.2 **Beckfoot Beat** (Scandal Beck)

Scandal Beck was walked from its confluence with the Eden to an upstream limit near the railway crossing. In this area obvious signs of channel realignment were noted, likely in part, due to the railway line, but also as part of the historic channel maintenance undertaken throughout the catchment to create larger, less fragmented grazing areas. It is apparent this treatment has not really had the desired effect as the river has reinstated a more natural, meandering course (Figures 11 & 12); something that has happened more actively due to grazing of the river banks. The initial erosion and movement of the channel to a more, sinuous course is positive, but it is now at a stage where stabilising the banks in its current course would be beneficial.

In many sections, the Beck is becoming over-wide, leading to shallowing (Figures 12 & 14) and there is a notable lack of trees, shrubs and herbaceous vegetation in the grazed sections. The monoculture of grasses and shallow root structure along the bank also means that as the banks slump, due to erosion undercutting, much of the material is washed away, rather than remaining in place to form a consolidated, re-graded bank (Figures 12 & 13).

Figure 11. A long section of erosion occurring where the beck has eroded the banks to reinstate a more sinuous channel course. Fencing is now required to exclude livestock to increase vegetation cover, allow tree regeneration and stabilise the banks to reduce the significant sediment input. If fenced, it may then be worth installing soft bank revetment

Figure 12. Over-widening and shallowing due to erosion. Note the significant lack of trees or bankside vegetation/cover.

Figure 13. A lack of root structure within sandy, friable banks is reducing the potential for bank stabilisation and natural re-grading as much of the earth will be washed out in high flows. The roots visible within the subsoil are from the trees in the background, rather than the turf and topsoil. Buffer fencing to allow a greater diversity of grasses and herbaceous vegetation would greatly assist in stabilising the upper and mid soil layers.

Figure 14. Significantly over wide section of the Beck where grazing and a fording point have destabilised the banks and exacerbated erosion.

Figure 15. Further erosion issues (blue arrow) where livestock are trampling/poaching the bank within the field around the end of a poorly maintained fence. Also note the large accumulation of fine sediment in the backwater area (red arrow).

Increased sedimentation, as a result of bank erosion (among other issues), can be seen in Figure 15, as can trampling and poaching of the ground around the end of a poorly maintained fence. Maintaining existing fences and installing new riverside buffer fencing to exclude livestock from the watercourse will allow more diverse vegetation and trees to become established which will greatly reduce erosion rates and improve habitat along the reach.

In the un-grazed areas, better habitat is evident where diverse vegetation and trees provide greater bank stability; this forces deeper areas to be scoured down, into the bed (Figure 16), rather than laterally into the banks. The tree canopies also provide valuable cover. However, decreased bank stability on the grazed bank still poses a risk of channel over-widening through erosion in higher flows and a loss of water depth.

A fence in the adjacent field also shows how high (out of bank) flows often find the old (paleo) channels in the adjacent fields, as evident by the flood debris. This is something that the farmer should be encouraged to maintain to prevent the fence being washed out.

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Figure 16. Where livestock is excluded from the bank and trees are present, some better habitat is available.

Figure 17. A fence crossing one of the rivers old channel courses in the adjacent field demonstrates a high water pathway where debris has accumulated against the fence. This highlights the fact that buffer fences may need to be designed to accommodate high flows and prevent them being washed out.

3.3 Ploughlands Beat

The upstream limit inspected on the Ploughlands beat was at the large vegetated island in the River Eden. At this point it became immediately apparent that, although the river was buffer fenced, sheep were still gaining access as evident by the short grass within the fence, wool on the fence wires and sheep erosion scars on the bank (Figure 18). As already detailed, even at low numbers, sheep on the river bank are likely to inhibit self-set shrubs and more lush herbaceous vegetation from becoming established, which will greatly limit the development of valuable riparian habitat.

The river here is subject to significant human interference with the channel having been rock armoured in places. Flows deflected into the bed by the rock armouring has forced a deeper pool area to develop (Figure 18), which does provide some good adult trout habitat; however, the same effect would occur along a naturally well tree-lined bank, which would also provide the benefit of good aerial cover from the branches. This is in contrast to the situation with rock armouring, where the matrix of rock makes it very difficult for trees and other vegetation to become established.

In the pool downstream, clay within the RB performs a similar function, with the cohesive material deflecting flows downstream and into the bed to scour another pool (Figure 19). Some of the vegetation and turf/topsoil has been lost along the waterline, probably where a layer of water has become trapped between the turf and soil causing it to slip. Planting willow whips along this bank would reduce the occurrence of bank slipping and provide great, low-level, fish-holding cover along the run.

The pool area provides an ideal demonstration of the way that bends in a river with active channel geomorphology benefit habitat. Scour on the outside of the bend creates the pool, while gravel and silt depositions on the inside of the bend provide shallow habitat and natural narrowing to the channel which helps to maintain the pool depth, even at low flow. Note the width at that point (Figure 19) is much less than the riffle and glide downstream (Figures 20 & 21); this means that the pinched flows within the pool actively transport sediment supplied from upstream, naturally maintaining its depth. As the energy dissipates downstream, material is deposited forming the gravel lift throughout the glide and riffle downstream. There, the sorted materials form potential spawning habitat. Unfortunately, the channel in Figure 20 is still over-wide at present and requires natural narrowing to keep the spawning substrate free from fine sediment.

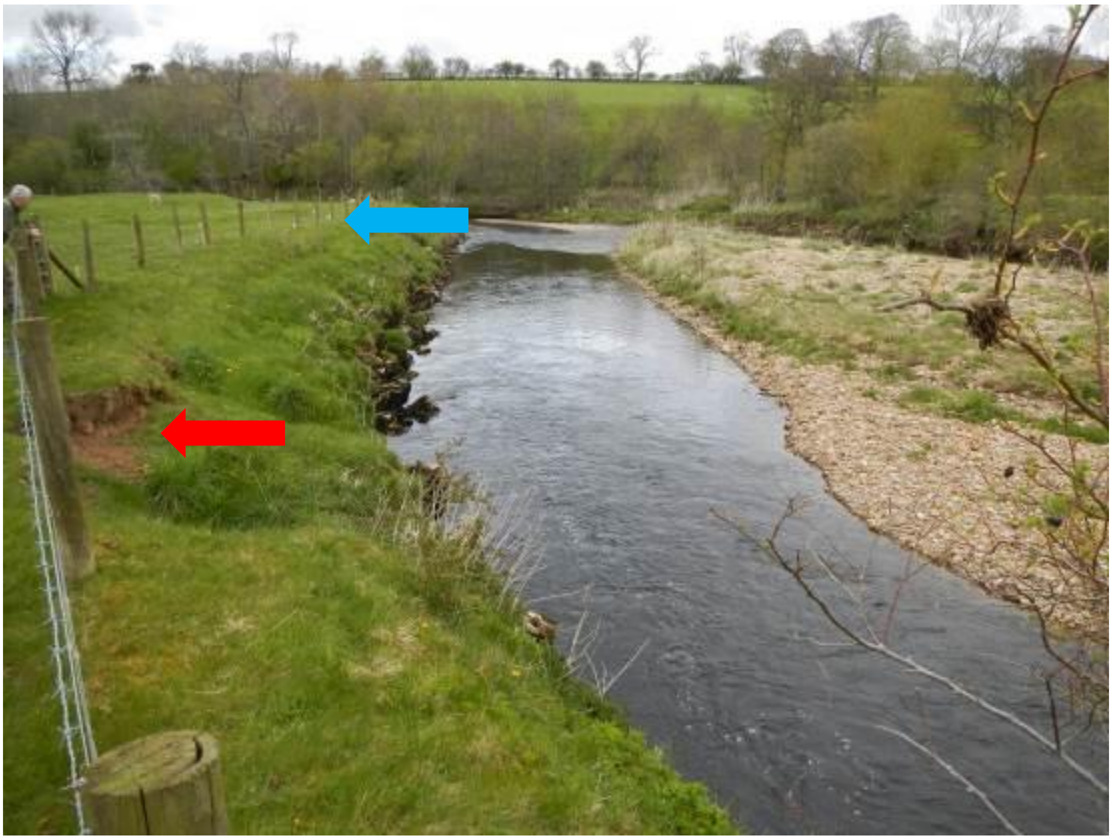

Figure 18. Obvious signs of sheep access into the buffer strip. Wool on the wire (blue arrow); no difference in grass length or vegetation structure either side of the fence, apart from the lower less accessible area; sheep scarring of the ground (red arrow). The rock armour within the bank and along the toe does force a deeper pool area but also inhibits valuable tree and vegetation cover along the river's edge.

Figure 19. Clay within the RB naturally creates a pool feature. It appears that water trapped between the turf and the clay has led to bank slippage. Greater tree coverage along the lower bank would reduce slippage and greatly improve the fish-holding capacity.

Large areas of the channel downstream of the pool appear to have been dredged and re-sectioned, leaving an over-capacity channel that is quite deeply incised (Figures 20, 21 and 22) and compromising areas that would otherwise be good spawning habitat for salmon and grayling (Figure 21). However, if stock can be kept off the river bank, natural narrowing will occur as sediment deposits within the river margin and becomes consolidated by vegetation, as is starting to occur (Figure 20). More willows along the bankside and within the river margin would be very valuable in trapping sediment and assisting the natural narrowing process (Figures 20 & 21).

Encouraging willow trees into the channel, as is already occurring in places, is of significant benefit to the deeper section (Figure 22). Increased structure within the channel provides cover in which fish can evade predators, narrowing and flow diversity, and the structure will also help to retain substrate where it touches the river bed.

The poorly vegetated area in the foreground of Figure 21 is a result of a stand of Himalayan balsam (Figure 23) which shades out other species during the growing season, then dies back to leave no root protection within the bank over winter. This should be dealt with to prevent its spread and even greater erosion issues.

Figure 20. Straight, likely re-sectioned channel. Low trees on the RB provide good cover for adult trout. Sediment depositions in the LB margin will consolidate and remain in place to provide valuable channel narrowing if sheep access is prevented. Planting a few trees (particularly willow for hinging in future) along this bank is advised to promote narrowing.

Figure 21. Over capacity channel where potential spawning habitat, particularly for salmon and grayling, is compromised by sedimentation. Owing to the large size of Eden trout, they too may use the area if sedimentation could be reduced. The poorly vegetated area in the foreground is a result of Himalayan balsam that should be dealt with.

Figure 22. Over-deep and wide section, where trailing trees provide vital cover in which fish can evade predators. They also increase the fish holding capacity by providing lies within what is otherwise poor habitat. As they fall into the river, the willows should help sediment to accumulate in the margin and, over time, start the channel narrowing process.

Figure 23. A young Himalayan balsam shoot found on the LB (in Figure 21).

Further downstream, the effect of sheep ingress to the buffer zone is even more significant (Figure 24), with the sheep erosion scarring and grazing pressure plain to see. Although the buffer is continuous, the adjacent fields are separated, and the lower field appears to be grazed more heavily than the upper one, which is encouraging sheep to enter the better vegetated buffer strip through the slack wires.

If lambs are used to climbing through a fence from a small size, they are more likely to continue to attempt it throughout their lives. Sheep that have been reared within well maintained fences tend to accept the fence as a barrier. (Consider the hefted sheep herds out on the fells which remain within specific areas, even without fencing, simply because they have grown up in a herd that have always existed within those boundaries).

For this reason, it is very important to maintain the tension of the plain strand fencing wire with the tensioners that are located at the straining posts (Figure 25) to keep the lambs, and ultimately, sheep out. It might be worth contacting the farmer to offer to do this for him, as it may lead to better maintenance. In addition to being an issue for the retention of a well vegetated strip, it is also an inconvenience for farmers when the sheep go through the fence and have to be retrieved, so it may be in their interest to let KSDAA undertake occasional maintenance.

Figure 24. Towards the downstream end of the buffer strip, poor tension of the wiring and greater stock densities allows results in increased access and grazing within the buffer (probably mostly lambs), and erosion is again evident.

Figure 25. The buffer fence is equipped with tensioners, which means that the wires can be tightened to improve its stockproofing. Note the gravel bar in the background with is the rivers way of naturally narrowing; at least part of this is likely to become vegetated if stock can be kept out.

A small tributary (Blind Beck) enters the Ploughlands beat (Figure 26). This is exactly the size and type of tributary that KSDAA should be focussing on as spawning and juvenile areas for trout that will populate the Association waters. However, despite having the basic characteristics (suitably sized gravels and flow characteristics), the Beck is in a poor state at present, with significant sedimentation that greatly reduces its potential to support fish stocks on the main river (Figure 28).

Land management upstream and grazing of the banks are major contributors to the sedimentation, but also affect the physical habitat. If the Beck can be buffer fenced to reduce erosion and allow natural narrowing that will scour the bed clean, and the other sediment inputs associated with farming practice upstream can be addressed, the Beck could be transformed. Buffer fencing would also allow the establishment of shaggy marginal vegetation that will support good fry habitat; with the associated, more stable banks, it may also be beneficial to install some small pieces of woody debris to further accentuate flows and scour/sort spawning gravel areas. This would serve as an excellent demonstration project to show the positive impact of the fencing and habitat improvement on a small scale, where anglers fishing the beat will be able to see it develop over time.

Figure 26. Blind Burn supports many of the characteristics required for a valuable spawning tributary in terms of gradient, basic substrate, depth and flow, but is compromised by sedimentation and grazing.

Figure 28. Substrate on the Blind Beck. The basic, natural substrate here should be ideal for trout spawning, but note the significant loading of fine material that renders it almost completely useless for salmonid spawning. Addressing the sediment inputs and fencing the beck could greatly improve natural trout production in the area.

4.0 Recommendations

4.1 Fencing

Effective fencing to exclude livestock from the riverbank is the area in which KSDAA can make the greatest improvements to habitats on the river. Excluding livestock from the watercourse via buffer fencing in the unfenced areas (particularly U/S Eastfield Bridge and on Scandal Beck) is the surest way to improve habitats there, preserve the bankside trees and promote healthy, better vegetated margins. It will also allow new trees to be planted or naturally regenerate in open areas, free from the continued impact of grazing.

Ideally, fencing should completely exclude livestock from the river bank which may then require solar pumps (Figure 29) or pasture pumps (Figure 30) to supply water for drinking.

Existing areas of fencing must also be maintained/improved to ensure that they fully exclude stock, particularly sheep, which will gain access through the smallest of gaps. Sheep, although small, cause significant issues due to their browsing/grazing style, which crops any growth back almost to ground level, leaving very little ground coverage or root structure remaining. They also actively target the vital self-set shrubs and saplings before they can become established because of their palatability.

Negotiations regarding additional fencing will have to be undertaken with the tenant farmers, but it would be hoped that if they are helped to understand the major impact that grazing is having upon the watercourse then they would be supportive, although some incentives may also be required.

It is recommended that links with Eden Rivers Trust are utilised in developing improvement projects resulting from the visit. Dan Brazier (ERT) has already submitted project proposals to the Environment Agency seeking funding for farm capital works on the Blind Beck catchment and buffer fencing and habitat improvement work on Blind Beck and Scandal Beck. ERT staff have a good knowledge of the catchment issues and understanding of the kind of work that is required, along with potential funding sources that may assist with delivery of improvement work. They will be very useful allies!

It would also be beneficial to include the Environment Agency in any future plans as they may have funding available (it is believed that Dan Brazier is already working on this) and to keep them informed. Andy Gowans (Environment Agency Fisheries Technical Specialist) was not available to attend the visit but is keen to receive a copy of this report. Similarly, Tim Nicholson and Chris Turner (Natural England) planned to attend but were unable, due to other commitments. They are, however, likely to be strong allies in securing funding/subsidies for fencing work and improved riparian land use, as indeed will John Garner.

The next round of Countryside Stewardship (2016) could provide landowners and / or and tenants with subsidies for land placed into buffer strips etc. and the Natural England contacts are ideally placed to help facilitate this.

Figure 29. Cattle excluded from a riverbank and watered via a pasture pump. The cattle draw water from the river through a pump which they activate themselves by pushing it with their nose.

Figure 30. Solar panel powered pumps employed to fill standard water troughs. (Photograph courtesy of Ribble Rivers Trust)

4.2 Tree Work

4.2.1 Planting

Once stockproof buffer fences are installed/maintained, patches of tree planting are recommended wherever there is a lack of low cover and structure along the river margins (notably on Scandal Beck), and particularly with willow where narrowing is required (Ploughlands - Figures 20-22). Most native deciduous species would be beneficial but willow is by far the easiest to transplant and manipulate.

The quickest and easiest way of planting is with willow, by pushing short sections of willow whip into the ground. This can be undertaken at any time of the year, but will have the greatest success if undertaken within the dormant season, shortly before spring growth begins (ideally late Jan-March). Whips should be planted into soft, wet earth/sediment so that there is a greater length within the ground than out of it, to minimise the distance that water has to be transported up the stem; 30-40cm of whip protruding from the ground is sufficient. Whips of 5mm-25mm in diameter tend to take best, but even large branches can be used.

Small bundles (faggots) of freshly cut willow can also be employed to rapidly increase marginal cover. If they are staked into sections of softer river bank, along the waterline, they have a good chance of rooting and becoming valuable, dense cover.

4.2.2 Laying

Where trees are available along the bank, habitat improvements can be easily achieved by laying the trunks, or selected branches down into the watercourse to increase low cover and in-channel structure. The method is usually limited to willow, elm, hazel, hawthorn and small alder, but some others can be laid carefully. Laying willows into over-wide sections, where available (Figure 22), or once they have been established on the open, wide sections (Ploughlands – around Figures 20-21) will be greatly beneficial.

The process involves cutting part way through the stem/trunk, a little at a time (like laying a hawthorn hedge), until it can be forced over into the channel (Figures 31 & 32). The depth of the cut should be limited to that required to bend the limb over, as this will retain maximum strength in the hinge and maintain the health of the tree/shrub. On smaller shrubs, cutting the stem/trunk at a shallow angle and then putting an axe blade into the cut and hitting it with a hammer can also help the laying while retaining a good strong hinge.

Figure 31. Hinged willow.

Figure 32. Hinged hazel.

4.2.3 Maintenance

No tree maintenance appears to have been undertaken on the KDSAA waters and it is recommended that this remains the case to preserve the valuable habitat the trees currently provide. The overhanging trees observed may occasionally obstruct access and mean that wading is required to access some lies, but the habitat they provide is vital for fish and invertebrates and is undoubtedly a large contributing factor to the good populations of both that exist on KDSAA waters.

4.3 Fish stock management

The current stock management on KSDAA waters, and the majority of the rest of the catchment has stood the test of time, with wild trout stocks thriving in the absence of stocking. The management policy of no-stocking is something to be commended and continued, alongside habitat improvements to preserve and promote wild fish populations.

It is understood that the majority of anglers fishing KDSAA waters practice catch and release and this is something to promote. The Eden and its tributaries can receive considerable angling pressure, particularly on certain beats and at certain times of the year, so it is important to preserve the valuable wild fish stocks wherever possible. Even taking the odd fish here and there can have a marked impact upon the population, especially if they are the 'trophy' fish, and it is far better to return them so that they can contribute to future generations. A well-managed fishery that operates as predominantly catch and release can provide a great deal more sport and enjoyment to a range of anglers than one that is over-exploited by a few.

4.4 Sewage

It is recommended that the sewage treatment works discharge at Eastfield Bridge is investigated as it appeared to be particularly discoloured and odorous (Figure 9), possibly indicating an issue.

More information on the measures discussed and many other enhancement and restoration techniques can be found in our various publications on the Wild Trout Trust website, under the library tab (http://www.wildtrout.org/content/library).

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, with the report forming part of a land drainage consent application.
- WTT Practical Visit
    - Where clubs are in need of assistance to carry out the kind of improvements highlighted in an advisory visit 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 enhancement methods described above. The recipient would be asked to contribute only to reasonable travel and subsistence costs of the WTT Officer. This service is in high demand and so may not always be possible.
- 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 Acknowledgement

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7.0 Disclaimer

This report is produced for guidance and not for specific advice; 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.