Advisory Visit

Town Beck and Back Beck, R. Wharfe, Addingham

13/12/2016

1.0 Introduction

This report is the output of a site visit undertaken by Jon Grey of the Wild Trout Trust to the two main becks (Town Beck and Back Beck) flowing through the village of Addingham, West Yorkshire (partly falling within the Wharfe from Barben Beck/River Dibb to Hundwith Beck (Waterbody ID: GB104027064257).

The visit was requested (and attended) by Rick Battarbee (Chair of the Addingham Civic Society Environment Group steering committee) and accompanied by various members of that committee (Janet Hindle, Stuart Tomlinson, Peter Miller), as well as long-term resident Barrie Turner, and Tony Brady (secretary of Addingham Angling Association); Dan Turner (Yorkshire Dales RT) gave advice during the morning of the visit and contributed to the report. The rationale was to assess habitat quality and identify any remedial actions that might be implemented.

Normal convention is applied with respect to bank identification, i.e. 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. The water level during the AV was noted from the most local Environment Agency gauge on Town Beck: 0.15m.

In many ways, these becks are typical northern, post-industrial, spate streams, falling rapidly from surrounding low fells through relatively narrow valleys where they have been shackled between walls to be used for mill power, and to allow for development of housing and road infrastructure as the human population expanded rapidly. The close proximity of roads to the becks' courses through the village mean that there are many crossing points, culverted sections, and run-off drains. Service pipework and bed-check type weirs frequently span the channels.

The Environment Agency consider Town Beck from its confluence with the Wharfe until it passes under the B6160 at SE 07746 49808 as main river and as heavily modified. In 2015, it achieved an overall water body status of moderate (based upon an ecological quality of moderate, and a chemical quality of good). Chemical quality has improved from fail in 2013.

2.0 Habitat Assessment

2.1 Town Beck (walked from d/s to u/s)

The starting point of the walked section was at the confluence with the River Wharfe at Low Mill (SE 09003 49460) at the d/s end of a low-lying island (Fig 1). As is typical for confluences of this type, the tributary channel is overly wide and hence flow from the beck is barely discernible. During high rainfall, spate flows from the beck tend to be overwhelmed by that within the main river and cause the deposition of substrate homogenously across the bed, creating a uniform, trapezoidal channel mouth (see also Fig 2 lower panel). The RB of Town Beck is walled but there are numerous native trees providing shade and cover, and the LB (island) appeared mostly native vegetation although some bare areas hint at Himalayan balsam issues. Certainly the riparian vegetation on the RB of the mainstem Wharfe (at the confluence) is better quality than that on the LB where it has been heavily grazed and is consequently eroding (Fig 1), and so fish are more likely to be using the cover near to the tributary mouth.

Fig 1. Mouth of Town Beck as it enters from the RB of the River Wharfe at Low Mill. The confluence was accessible, but at lower flows access could be compromised by the uniform depth profile of the tributary channel

Immediately u/s, several landowners have introduced stepping-stones across to the island which have created several impounded sections and contributed to further deposition of bed material (Fig 2a&b). Impounded sections of slow water with little underwater habitat complexity provide easier conditions for fish predators (such as herons, goosanders and mink) to hunt.

Fig 2. Upper: looking d/s at an impounded section caused by stepping stones from the properties on the RB. Lower: uniform deposition of sediments caused as the beck spate flow backs up against mainstem river flow. Note the straightened channel maintained by the walled RB protecting the road.

Town Beck flows through the grounds of a large private house, and the channel and path have been heavily modified for aesthetic purposes and presumably to restrict flooding across the manicured lawns. The work will have required consent from the Environment Agency. The banks have been replaced by stone walls in places, there is a formal weir which may cover a service pipe or may simply be to introduce the sound of a burbling stream, and the bankside vegetation is primarily mown grass (Fig 3). One slight saving grace is that the path of the beck has been created to meander relatively naturally through the grounds. While a close look was not possible, deposition was clearly occurring on the inside of bends (Fig 3 lower panel) and natural recreation of a channel form of more appropriate proportions was evident (two-stage channel meanders within the artificial channel).

Fig 3. The (mostly) walled channel made to meander through the private gardens. Upper: the weir is a barrier to fish passage and geomorphology and may just be aesthetic. Lower: deposition processes reclaiming a more natural meandering channel morphology within the walls. Note the distinct lack of riparian cover.

At SE 08510 49609, Town Beck flows through the grounds of the Church, an open meadow with some historic fish stock ponds, and its path has clearly been shunted to the side of the available space to make one coherent field. The grassland is clearly managed but not in a sympathetic manner for the beck (Fig 4). Mowing of grass right to the bank edge essentially causes the same issues as livestock grazing. Plant energy is constantly diverted into replenishing shoot rather than into root growth and consequently there is a lack of physical root matrix in the soil to provide physical stability to the bank structure. It also culminates in a near monoculture of short sward grasses instead of a diverse riparian plant assemblage which would not only introduce a greater variability in root matrix and provide overhanging fringing cover to the beck edges, but also begets greater faunal diversity.

Fig 4. Various images from the church meadow. Upper: compacted soils from footfall, and a mudslide of eroded bank where dogs access the beck. Mid: mown vegetation to the bank edge. Lower: exotic vegetation planted along the banks and evidence of heavy pruning of overhanging scrub.

Wherever there is public access, there is the added pressure of excessive footfall compacting soils and trampling vegetation, and a requirement for access points to the beck, e.g. for dogs. The erosive scouring of dogs entering and exiting the beck can be clearly seen in

Fig 4 upper panel; it also introduces unwanted fine sediments that clog the interstices between gravels, a demand for oxygen as the organic content is mineralised, and prolonged activity at one site can lead to guttering of rainwater from overland flow. However, an accessible and popular point on the beck such as this could also be used to good effect as an engagement and education site.

Various exotic trees and shrubs have been planted along the bank edges while native flora has been mown or pruned right back. Heavy pruning of overhanging scrub (Fig 4 lower panel) is probably to alleviate perceived flood risk. However, by removing the fringing vegetation, it is not only habitat being degraded but elements of natural flood management (slowing the flow as water works through and around trailing branches) are removed as well. Removal of the natural vegetation exposes the bank soils to more erosive force during spates and reduces their resilience to future events. It is clear from the lower panel in Fig 4 that the RB and indeed the LB in places (around a step-weir) had been reinforced with wooden hoarding, and some sections very recently. Any work of this nature must be approved by the Environment Agency.

From the u/s end of this field (SE 08367 49686), the beck becomes heavily entrained through housing and under roads, and was only accessible, and hence, spot-checked at various locations. Ideally, it should be walked (i.e. along the bed) to check for any obstructions or issues such as drains which are not immediately visible from vantage points.

Fig 5. The lowest extent of the beck where it was walled and with housing on both banks. Note the angle of the two weirs to change the course of the beck and reduce erosive power on the outside of the bend.

There are numerous bed-check weirs and weirs to divert the flow path and reduce the erosive force on the outside of bends where the channel has been forced to make sharp turns (Fig 5). Each of these is a barrier to free fish passage, with numerous other insidious effects, as well as interrupting the natural movement of substrate downstream. The bed-check weirs have probably been installed to counter the intensive straightening of the channel, which has considerably shortened the natural (meandering) path and hence increased the gradient and increased the flow velocity; this can be seen as long continuous riffles in the straightened sections (e.g. Fig 6). The impounded sections above each weir are relatively short, primarily because of the gradient issues mentioned above. The impoundments are also shallow because substrate has deposited over time and built up to the crest of each weir.

Fig 6. Looking d/s (left) and u/s (right) from the footpath running beside the sawmill pond (SE 08017 49878). The beck is one continuous riffle, a function of it having been straightened. The bed is a heterogeneous mix of substrate sizes offering little in terms of holding habitat for larger fish. However, the native riparian vegetation is one small bonus.

The pools below each weir are short and wide because the flow energy has been dissipated across the entire width of the beck, and hence are not particularly deep in most instances. Thus, they provide little depth heterogeneity, limited power to sort substrates (particularly gravels) and offer poor trout holding habitat, especially as there is rarely any overhanging vegetation nearby. As many of the weirs have a head-loss of <50cm, and their structure is integral to that of the walled banks, notching, rather than removal is an option to mitigate their environmental impacts (see *Recommendations*).

The straightened section running parallel to the sawmill pond and d/s for ~100m (Fig 6) does have natural riparian vegetation and where the root boles of trees are at the waterline, there is evidence of downward scouring and the development of some variation in depth profile. Seemingly inconsequential features such as this will be of benefit to fish and can be replicated very easily without increasing flood risk.

Fig 7. Back Beck (left) meets Town Beck (right) head on and flow under the Bolton Road bridge at SE 07898 49921. The flat concrete apron spanning the bridge culvert and extending d/s is an issue for fish passage.

A short distance upstream from the sawmill pond, the Town Beck flows under Bolton Road where it is joined by Back Beck; the confluence occurs immediately u/s of the bridge. The bridge culvert consists of a flat concrete apron and presents a considerable barrier to fish passage because of the shallow depth and fluming nature of the flow (Fig 7).

Town Beck then follows Bolton Road and Main Street through Addingham, generally tightly constrained by walling (Fig 8) and through several long culverts where it is crossed by roads and beneath several residential and commercial properties. Where the beck does have room to wiggle slightly, and where vegetation has been allowed to grow within the confines of the walled banks, there is actually some reasonable habitat: retention of small pockets of gravels instream, trailing bankside vegetation providing low cover, and pockets of deeper water between larger boulders (Fig 9).

Fig 8. Town Beck tightly constrained by the B6160 Bolton Road.

Fig 9. A historic ford. Whilst straightened and hence operating over a steeper gradient, the larger boulders and unkempt vegetation (further u/s) provide deeper pockets of water, and refugia from flow and predators.

Culverted bed sections (concrete and laid stone) and small step weirs (protecting service pipework and used to change the beck direction) are numerous (eg Figs 10 & 11) but not impossible to improve for fish passage. Anecdotally, the bridge in Fig 10 above the pipes/weir, is the highest point that trout have been seen by the AV attendees.

Fig 10. The Environment Agency gauge situated immediately u/s of a series of metal pipes spanning the channel. Deposition of sediment on the RB has allowed native and non-native vegetation to flourish and provide some much needed cover.

Fig 11. Concrete on stone culverting of the beck bed (left) and a check weir immediately d/s of another long culverted section of Town Beck (right) at SE 07303 49859.

Due to the intertwined nature of the road and the beck, longer culverted sections (20-30m, and ~100m under the business park) become more prominent until the housing becomes less dense at SE 07167 49911 next to the junction of Silsden Rd and Main St. Above the business park, the beck regains a much more natural riparian fringe and channel form and offers some apparently good quality habitat (Fig 12). The caveat is that the substrate comprises a considerable quantity of glass, tile and brick intermingled with the natural stone / cobble / gravel matrix and introduced from the village tip that is now closed.

Fig 12. Much more natural channel morphology, substrate heterogeneity and riparian vegetation u/s of the business park.

Fig 13. The large scour pool immediately d/s of a box culvert and a perched pipe (seen to the right) which pass beneath Big Meadow Drive. The ramp up to the culvert is clearly an issue for fish passage. The water emanating from the pipe had a distinct organic smell and should be investigated.

This less impacted section lasts for ~250m until the valley has been effectively dammed for the construction of Big Meadow Drive, and the beck is constrained to a box culvert for ~40m (Fig 13). It would be interesting to investigate the rationale / design for this structure; it looks like it should act as a choke on the beck during high flows and the valley above the culvert has potential to hold back a considerable volume of water, yet no attendees could recall it operating as such. Erosion scour from the beck exiting the culvert had caused the formation of a relatively deep pool (Fig 13); the ramp up to the culvert mouth and the length of the culvert itself present considerable issues to fish passage, but could be lessened by the installation of a pre-barrage to increase the depth of the pool and drown out the ramp and mouth of the culvert (see *Recommendations*). The pipe delivering water next to the culvert in Fig 13 had a distinctly organic odour and should be investigated.

Fig 14. The confluence of Marchup Beck to the right of shot and an un-named beck from Addingham Middle Moor (under the bridge to left) to form Town Beck.

The habitat potential remained reasonably good (as below the culvert) until the confluence of Marchup Beck and an un-named beck (which together form Town Beck; Fig 14), ~300m u/s of the culvert. A quick spot-check of invertebrates by stone turning here revealed several species of cased and caseless caddis (Trichoptera), stone-clinger mayfly (Heptageniidae) and freshwater shrimp (Gammaridae) indicating reasonable water quality and food availability for fish. Immediately u/s on the LB of Marchup Beck is where the village tip spoil enters, so the presence of the invertebrates at least suggest nothing noxious is leaking from that site.


Fig 15. The d/s end of the long, corrugated culvert beneath the A65.

Two spot checks were made at either end of the culvert which transports Marchup Beck below the A65, and u/s for a further ~300m but then there was a natural barrier, a waterfall over bedrock. Hence, it is of little value to consider options for this culvert.

2.2 Back Beck (walked from d/s to u/s)

Back Beck was walked from the confluence with Town Beck (Fig 7) to where it peeled away from Chapel Street. It is smaller than Town Beck but suffers similar constraints, straightening and obstructions.

The walled banks have been colonised by native trees, and retention of root masses near the toes of the bank and the introduction of woody material (Fig 16) have allowed pockets of gravels of a suitable size to be used for spawning to be retained. The beck flows past the primary school and the natural vegetation at that point provides good quality riparian habitat, shade, and better protection from disturbance by passers-by. This is an ideal spot for engagement with the local school-children.

Just upstream from the school, is a scour pool formed at the exit of a long straight culvert which forces Back Beck beneath Bridge 55 (Fig 17). The extra depth and rocky substrate provide good cover for fish and it is little surprise that this is considered the upstream extent of the trout population; the step weir is impassable. It would be interesting to consider electrofishing Back Beck above the village (not seen during the visit) as the potential for a remnant population up there is high given the quality of habitat observed at a distance.

Fig 16. Woody material and tree roots within the walled channel of Back Beck actually help to sort the gravel substrate and provide some limited refugia.

Fig 17. The pool below 'Bridge 55' and the upstream limit of trout (anecdotal evidence provided by attendees). The step weir is ~1m high, and the channel upstream is concrete / stone-lined extending for ~40m.

Above the Bridge 55 culvert, the gradient and habitat are better, as the beck is allowed to meander and is bordered by more natural riparian vegetation (Fig 18). The highest point up this tributary seen was at the remnants of the old school site.

Fig 18. Back Beck near to the site of the old school. More unkempt bankside vegetation and meandering form present better quality habitat.

3.0 Recommendations

The fact that trout have been observed by numerous residents well up each of the tributaries within the confines of the village is testament to the adaptability and resilience of the species. Assuming that water quality is OK, and there were several pipes / outfalls noted during the visit that should be investigated, there is potential to enhance the habitat and hence the fish holding capacity and improve its attractiveness to other wildlife with some simple and cost effective instream works. While the scale is small, the benefits will be maximised and contribute to the longer term, overall aim of restoring connectivity throughout the broader catchment thereby creating a positive impact upon multiple water bodies. In freestone, spate rivers like the Wharfe, it is the smaller tributaries like Town Beck and Back Beck which are important for spawning habitat and juvenile refugia. Obviously, it will be important to engage with all the stakeholders throughout the village and include due consideration of local interests. Any proposals should be made publicly available to allow for consultation and input.

The proposals here are to enhance or restore the beck under low to base-flow conditions. None of what is proposed will impede spate flow which will quickly overtop any structures. Consent will be required from the appropriate authority for works involving flood risk (either Environment Agency on main river, or County Council elsewhere)

3.1 Weirs

Weir removal markedly benefits connectivity. It is important to remember that this is not solely for substrate and fish (and other biota), but also habitat variety (and consequently quality), water quality and potential flood risk due to reduced impoundment within the channel.

The best all round solution would be complete removal of any redundant weir structures to allow geomorphology to naturally reshape the channel to the benefit of the beck's ecology. If this is not feasible, then cutting a notch or slot in the weir crest, or removal of a block of stone (dependent upon construction) down to as close to the current d/s bed level without risking the integrity of the structure, would be highly beneficial. Each slot should be wide enough to largely remove the upstream impounding effect of each structure. A number of the concrete-lipped or stone block weirs already have degraded notches which could be exploited and 'encouraged' to degrade further. Each slot should be sited anywhere within the central third of the structure so that it does not unduly influence bank (wall) erosion. Focussing of the flow within one area will aid bed scour to form deeper pools (for refuge and to hold larger fish) and gravel sorting (thereby augmenting spawning habitat). This work might require physical destruction of parts of the d/s aprons (if present) to allow fish sufficient water depth to access the base of the weir.

If the impoundment effects essentially can be removed by cutting a sufficiently wide (off-centre) slot in the weirs then there is merit in retaining/forming point-bar structures from the remaining weir structure left in place. The exact proportions of the beck (i.e. distance between weirs) needs to be assessed but if the slots were introduced toward a different bank on alternate weirs, then it should promote a more natural sinuosity within the channel which will be retained at base-flow. The result will be a narrower but deeper channel at base flow which maintains sufficient energy to keep the gravel matrix clear of fine silts, and the increased depth of water will allow a greater size range of fish to be retained throughout the year.

Any broken stone or concrete material removed from weir structures should be retained instream to augment the valuable boulder / pocket water habitat that is already developing.

3.2 Encouraging further channel sinuosity & bed heterogeneity at base flow

Currently, base-flow water level throughout much of each beck system is spread across the entire trapezoidal channel for long reaches; it is, therefore, too shallow in the pool sections as the flow energy is dissipated across too wide a cross-section to scour or sort the bed substrates. Hence, the wetted channel width and the deposited bed substrate (an aggregated mixture of fine sands, silt, gravels and cobbles with occasional boulders) are too uniform. A naturally diverse channel should vary in both width and depth.

The mix of particle sizes and lack of sorting means that there is very little potential for gaps to exist between larger, ill-fitting substrates, particularly the smaller (10-40mm) gravels which are important for invertebrates and trout spawning. Such gaps in the substrate matrix (that must remain free of sand or silt blockages) are vital if eggs laid within a gravel mound are to be continually irrigated by oxygenated water. Without irrigation, trout eggs will suffocate. Therefore, it is important to retain sufficient energy within the channel to create natural glides, riffles and pools which maintain 'clean' gravel by scouring. The constant impoundment of the beck at present is preventing or compromising these features.

The notching or slotting of the weirs recommended above should kick start a process of re-naturalising and reverting the channel in the impounded reaches to a more sinuous form after one or two flushes from higher spate flow. However, it may be possible to facilitate this process and reintroduce cross-sectional variation in both physical structure and current flow by deliberate installation of LWD in a staggered, alternating pattern on both margins. Additional benefits arising from such structures are improved cover and trapping of leaf litter, providing a greater degree of insurance against excessive predation of nascent fish populations and boosting production of invertebrates.

This could be achieved by introducing short sections (<2m) of tree limbs securely pinned next to the wall banks or cabled to existing living trees, which are essentially mimics of natural wood fall organised to maximise habitat potential (See WTT video:

http://www.wildtrout.org/content/how-videos#log). Arranging these in an alternating, staggered fashion will promote meandering flow, whilst arranging in a matching pair on opposing banks will achieve a degree of channel pinching or narrowing. Both alterations to the flow are desirable and should be considered in locations such as Church Meadow (Fig 4) and d/s of the sawmill pond (Fig 6) on Town Beck, or near to the school on Back Beck.

LWD deflectors may eventually become consumed naturally by the deposition of bed substrate. However, their physical presence will still be deflecting flows, something which is severely lacking at present.

3.3 Riparian management of vegetation

More riparian growth could be promoted in open areas, especially to protect the banks from block failure and erosion from footfall (and dogs entering and exiting the water) around, for example, Church meadow (Fig 4). Grass should not be mown to the bank edge, but a buffer strip of natural vegetation left uncut. It is not intended that the buffer strip ultimately blocks the view of the beck, nor prevents access, but it will require some sensitive management to achieve the desired results, i.e. a more stable bank and a buffer that provides a) shelter and food for riparian animals, and b) protects the beck from soil ingress.

Non-native vegetation should be removed. The proximity of the beck next to gardens and dwellings has led to considerable introduction, both deliberate and accidental, of non-native species that do not contribute to the healthy functioning of the ecosystem. Removal sites should be replanted with native species so as not to leave a bare bank. It would be useful to have several designated monitors within the community who are trained in the ID and control of Invasive Non-Native Species (INNS) such as Himalayan balsam and Japanese knotweed (among others).

3.4 Fish populations

Exploration of the becks above the village using electrofishing equipment might reveal remnant populations, currently cut-off by barriers. Obviously reinstating connectivity throughout to allow fish from the Wharfe to reach as high up the headwaters as they can (naturally) is the ideal but is likely impractical. However, progeny from an isolated population upstream may still travel downstream and contribute to the wider gene pool, so determining that potential is worthwhile, as the habitat upstream beyond the limits of this visit looks good in places on Google Earth.

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 (www.wildtrout.org/content/library).

3.5 Wider Community Project

The Yorkshire Dales RT believe, due a strong and well connected community, that Addingham village would be a good place to run a community project based around Sustainable Urban Drainage Systems (SUDS) in rural areas.

Figures from the Environment Agency show that 581 properties in Addingham are at risk from a 1 in 100 year flood, suggesting there is need to increase awareness of flooding and associated issues. Addingham Primary School runs alongside Back Beck, and therefore it might be an opportunity for the school to host a 'river garden' on land they own. This area could be used to demonstrate different SUDS methods, getting the children involved in the creation and then running demonstration days.

There are limited water quality data available for Addingham. Rolling out a Citizen Science monitoring programme (Water Quality Watchers) could be a good way of getting the community more involved with river management but also highlight possible sources of pollution. As long lengths of both becks run through the village, they could be affected by misconnections and associated urban pollution. This could be a good place roll out a 'Yellow Fish' Campaign which involves spray painting a Yellow Fish symbol on drain covers to highlight which drains go directly into the river, promoting 'Only Rain Down the Drain' and tying in nicely with a citizen science project.

4.0 Making it Happen

The WTT may be able to offer further assistance:

- 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 highlight specific areas for work, with the report forming part of a land drainage consent application.
- WTT Practical Visit
  - Where recipients 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.

5.0 Acknowledgement

The WTT would like to thank the Environment Agency for supporting the advisory and practical visit programme in England, through a partnership funded using rod licence income.

6.0 Disclaimer

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