WILD TROUT TRUST

Boyken Burn

(Border Esk tributary)

Dumfries and Galloway

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Contents

Key Findings

- A near impassable waterfall separates the upper and lower half of Boyken Burn, greatly reducing the areas available for spawning. The narrow, steep nature of the valley also reduces the potential to retain gravel and smaller cobble spawning substrate in many areas.
- A lack of bankside trees reduces the input of leaf litter and woody material to the watercourse, reducing its already naturally low productivity and livestock grazing in the lower half of the watercourse is supressing tree regeneration. Deer grazing may be causing similar issues in the upper catchment.
- The aforementioned issues almost certainly contribute to lower than expected juvenile salmonid numbers observed in the burn.
- Tree and willow whip planting could help to improve the productivity of the watercourse and buffer fencing would be beneficial in facilitating this, in most areas.
- There may also be opportunities for more ambitious channel restoration works in several areas, where straightening has occurred and valuable, gradient-reducing meanders have been cut off.

1. Introduction

This report is the output of a WTT walkover on the Boyken Burn, at the request of Galloway Fisheries Trust, Esk and Liddel Angling Club and the Environment Agency. The purpose was to identify issues likely to be driving poor performance of juvenile salmonids.

The burn was walked in a downstream direction from a small reservoir within a large area of forestry plantation in the headwaters, to the Border Esk. Photos used in this report represent only a selection of those taken during the walkover. The full suite can be provided to the recipients upon request.

Specific locations are identified using decimal latitude and longitude (e.g. **56.044896098, -3.16176523829**), which can be pasted straight into Google Maps to identify locations. Figure references within the text of the report are hyperlinked (green font), so holding Ctrl and left-clicking on them will move to that point within the document.

2. Background

Table 1. Waterbody details

River	Esk (closest WFD waterbody)
Waterbody Name	Penwhirn Burn (not a WFD waterbody)
Waterbody ID	10758 (closest WFD waterbody)
Operational Catchment	River Esk (Black Esk to National Boundary)
Management Catchment	Border Esk
River Basin District	Solway Tweed
Current Ecological Quality	Good
U/S limit	55.190399521, -3.071914875
D/S limit	55.190718933, -3.138143641
Length of river inspected (KM)	5.5

The geology of the Boyken Burn catchment is predominantly a tough sedimentary sandstone known as wacke, which is overlain by till and areas of peat. This geology is likely to impart limited nutrients, producing relatively unproductive watercourses; something that often leads to the adoption of a migratory life strategy among salmonids. As such, it would be expected that a large proportion of trout population in the accessible reach of the burn are sea trout.

3. Habitat Assessment

Boyken Burn was walked from a small reservoir on Yadlairs Sike, in the upper catchment of Eild Burn, which joins several other burns to become Boyken Burn. Conditions on the day were dry and clear, with the water appearing to be around low winter level and relatively clear.

Figure 1. The initial section of watercourse walked was very overgrown, with limited accessibility for fish, but will support various invertebrate species.

Figure 2. Eild Burn (55.190088, -3.134803), which appeared to also be fed from an alternative outflow from the reservoir was much larger and could certainly support trout, if they are present. However, most areas lacked bankside trees and the shade and organic inputs they would provide. Numerous signs of deer were noted around the valley, highlighting at least one reason that tree regeneration may be suppressed here.

Figure 3. The substrate was relatively free from fine sediment and of a suitable size for trout spawning.

Figure 4. The straightness and steepness of the burn, almost certainly influenced by past land drainage, limited water depth and there was a lack of pools. This in turn reduced the availability of ideal spawning habitat, but opportunities were available. Most of this area and the areas d/s would benefit from more bankside trees and at least Willow whip planting (55.189712, -3.134832).

Figure 5. One of few, slight bends: if greater meandering and width variability were created/encouraged, more fish holding pools and gravel lifts, providing improved spawning opportunities and invertebrate habitat would naturally form.

Figure 6. Light planting with native broadleaves had been undertaken through the valley, within a generous buffer from the coniferous plantations. While some of the trees did not appear to be in the greatest health, they provide valuable diversity; the issue could be related to a lack of trees there previously and slow reinstatement of the mycorrhizal network, which should develop with time.

Figure 7. Potential salmonid (primarily trout) spawning gravel deposition, facilitated by a slightly wider area of channel. It would be worthwhile ascertaining whether fish are this far up the watercourse, u/s of the large waterfall.

Figure 8. A straightened section of watercourse (55.18508, -3.13377), with paleochannels (including LH meander) still visible (white dashed line). Such straightening reduces the watercourse's ability to create pools and depth variation, and to naturally sort and store a natural array of substrate. This could be very easily reinstated.

Figure 9. Trough Burn (55.183915, -3.133568), which drains the westerly valley in the upper catchment of Boyken Burn is a similar size and character to Eild Burn and would similarly benefit from bankside tree planting (at least Willow whip planting).

Figure 10. Although lacking cover and in-channel structure, some potential salmonid spawning habitat was retained.

Figure 11. D/s of Trough Burn the now much larger watercourse was also clearly straightened (approximate past course - dashed white line), reducing gravel retention and increasing incision. This channel could be restored (55.18405,-3.132652).

Figure 12. The next straightened section also had potential for reinstatement (55.18431,-3.130378). The main issue in doing so would be the level of incision that has occurred, requiring raising the channel to the original level, however, it is certainly still achievable.

Figure 13. One of the few bankside willows observed in the upper section (55.184098, -3.129988). It would be beneficial to transplant cuttings to replicate this throughout the reach (Willow whip planting). If that were done, it would be beneficial to hinge this tree into the channel (Tree hinging); if not, it is best left as a standing bankside tree.

Figure 14. A major waterfall bisects the upper and lower habitat of Boyken Burn (55.183592, -3.126713). It would be useful to ascertain what, if any, fish populations are sustained u/s.

Figure 15, D/s of the waterfall, more wider areas of channel were observed, with a corresponding increase of gravel deposits – although they are still not in ideal areas for salmonid spawning, predominantly occurring in the sheltered margins.

Figure 16. Clackanna Sike is a steep and poorly accessible tributary, with the track crossing creating an additional obstruction (55.1833578, -3.1258847).

Figure 17. Looking u/s at the confluence with Boyken Burn: even the first 20m create an obstacle to fish (55.1837557, -3.1257363), owing to exposed bedrock (left of shot).

Figure 18. Further valuable gravel deposits in the lee of a boulder. This could offer some potential for salmonid spawning but also provides important habitat diversity for invertebrates.

Figure 19. The roughness of the generally cobble bed does retain some gravel, but not typical spawning riffles. More bankside/trailing and in-channel structure could help baffle peak flows and increase gravel retention.

Figure 20. Another straightened section: note the boulder/cobble nature of the straightened, steepened channel (55.185008, -3.119887). The watercourse should be flowing off to the left of shot, as per the previous straightening. Potential for bed raising/restoration to reinstate the paleochannel.

Figure 21. Even in more sinuous sections, this steep watercourse lacks the finer sizes of coarse substrate (55.185035, -3.117865) – the scarcity of bankside trees and in-channel woody material exacerbate the issue. Planting here would be beneficial and the installation of very large woody material could facilitate significant channel recovery.

Figure 22. where a few bankside trees (sycamore) were observed, the undercut bank and shade provide a valuable addition. The trees could form an anchor point for Lodged Woody Material.

Figure 23. Without the protection of bankside tree roots, several of the sharper bends were subject to erosion and land-slipping (55.185703, -3.115677). It may be possible to install some Pinned Woody Material here on either bank, but it would require adequate anchoring to the bed and bank.

Figure 24. The bends and slightly wider channel areas did provide some improved gravel retention.

Figure 25. At approximately 1/3 of the way through the walkover, the valley opened slightly facilitating a slightly more meandering course (55.188298, -3.11035). The area also became more heavily grazed. Buffer fencing would be beneficial, coupled with bankside planting.

Figure 26. Stone turning revealed the expected invertebrates: predominantly heptageniid mayflies (white circle) and stoneflies, with occasional caddis in the slower areas. The lack of slack water and organic material in-channel is clearly limiting the numbers of detritivorous species.

Figure 27. Numerous paleochannels were evident in the floodplain, some potentially naturally abandoned, but others (as here) almost certainly resulting from artificial straightening (55.187552, -3.104055). The meanders could be reconnected through restoration.

Figure 28. Progressing d/s, bankside trees become a more regular occurrence, although their veteran status highlights the issue of livestock grazing preventing regeneration (55.187177, -3.10067). Existing trees could be used as anchors for Lodged Woody Material to increase flow diversity and sediment deposition, and to provide more cover for fish and invertebrates.

Figure 29. As u/s, wider areas retained some smaller gravel, but spawning habitat was limited.

Figure 30. A bankside willow (55.187195, -3.097787) offers an opportunity for hinging to reinstate some of the lacking in-channel woody material. Care should be taken to ensure it is not left within the danger-zone of livestock browsing.

Figure 31. The potential of a viable spawning tributary is greatly reduced by the obstruction of a poorly installed, perched culvert (55.186822, -3.097292). While passable, this greatly reduces the opportunities for adult and juvenile salmonids to ascend.

Figure 32. The heavily grazed banks around Calkin leave limited opportunity for bankside trees (55.18758, -3.095863); however, two small alders had managed to become established by growing out over the channel (out of reach). Replicating this with willow whips could afford them a chance, but it would be far better to exclude livestock from the riparian zone.

Figure 33. Naturally lodged woody material. There would and should be more of this valuable habitat in the upper ~2/3 of the burn, if there were more trees.

Figure 34. The next field d/s was similarly grazed, with an island of trees strongly suggesting they have been outflanked by excessive bankside erosion – a symptom of heavy sheep grazing.

Figure 35. Another series of lost meanders. The abrupt nature of the cut-off suggest they may have been artificially straightened (55.186573, -3.089977). Increased trees and woody material in these areas could help the channel re-naturalise. Buffer fencing would also be beneficial.

Figure 36. Where a greater number of bankside trees are present, there is greater opportunity for increasing woody material to the channel (55.18616, -3.08885). Unfortunately, the suitability of this otherwise ideal location for Lodged Woody Material is reduced by the steep gradient, but some use of the technique here would still be worthwhile.

Figure 37. Track erosion and a likely source of surface runoff and fine sediment to the burn (55.185787, -3.084923).

Figure 38. Further signs of lost paleochannels, some of which will be natural, but the incredibly straight, incised and embanked channel alongside suggest modification.

Figure 39. Where trees were present at even slight bends and/or lower gradient areas, valuable pool features were observed. The reinforcement of the bank by the tree and the undershot/overtopping scour from the branch maintains additional depth.

Figure 40. Potential spawning at the tail of a more sedate, larger-capacity pool, significantly enhanced by the availability of deeper water and overhanging/trailing cover nearby. The trailing cover will also help to dissipate peak flow energy to encourage the deposition of spawning substrate d/s.

Figure 41. Glenbertle Burn suffers the same issue as many of the southern Boyken Burn tributaries, with fish passage greatly inhibited by a perched track culvert (55.185678, -3.077052).

Figure 42. Just d/s of the Glenbertle Burn, the LB of Boyken Burn was being used to store wood and rubbish, with some of the rubbish items sufficiently close to be washed into the burn on a moderately high flow (55.1863, -3.076835).

Figure 43. The large bend and lower gradient d/s of Old Hopsprigg creates good conditions for gravel retention and [potential salmonid spawning. Unfortunately, an access track crosses one of the prime potential locations at the tail of a pool (55.186673, -3.076423).

Figure 44. Habitat in the wood d/s of the ford was high quality, with low cover and structure.

Figure 45. U/s of the B709, the bankside trees appear to have all been coppiced at the same time, presumably during the conifer harvest, which greatly denuded habitat. Subsequent uniform regrowth will result in uniform shading. The requirement to even fell the bankside trees in such situations should be questioned, with a presumption to retain valuable bankside trees. This would be relevant to protect other areas owned by the estate.

Figure 46. D/s of the road, habitat improved again, but would benefit from more in-channel woody material (55.190138, -3.072103).

4. Recommendations

As a general recommendation, all areas visited would benefit from greater tree cover, particularly along the banks sides (where it is currently lacking). This would be highly beneficial to the fish and invertebrate populations of the lower burn (below the waterfall) if undertaken there, but also in the areas upstream of the falls, as any leaf litter and woody material input would help to naturally increase the productivity of the entire burn, along with greatly improving habitat quality. Opportunities to buffer fence and undertake channel restoration should also be explored, with woody material installation beneficial throughout the burn.

Table 2. Summary of recommendations

Name	Recommendations	Latitude	Longitude
Figure 5	Planting (willow whip and saplings)	55.18925	-3.134995
Figure 8	Channel restoration	55.18508	-3.13377
Figure 11	Channel restoration	55.18405	-3.132652
Figure 12	Channel restoration	55.18431	-3.130378
Figure 13	Tree hinging and planting (willow whip and saplings)	55.184098	-3.129988
Figure 20	Tree and whip planting. Possible channel restoration with large trees	55.185008	-3.119887
Figure 21	Tree and whip planting. Possible channel restoration with large trees	55.185035	-3.117865
Figure 22	Lodged woody material	55.185295	-3.117158
Figure 23	Pinned woody material	55.185703	-3.115677
Figure 24	Buffer fencing d/s	55.188298	-3.11035
Figure 27	Possible channel restoration	55.187552	-3.104055
Figure 28	Lodged woody material (here and with nearby trees)	55.187177	-3.10067
Figure 30	Willow hinging	55.187195	-3.097787
Figure 31	Fish easement - difficult towing to track above	55.186822	-3.097292
Figure 32	Buffer fencing and tree planting (at least willow whips out of livestock reach)	55.18758	-3.095863
Figure 35	Buffer fencing, tree planting and woody material	55.186573	-3.089977
Figure 36	Lodged woody material (here and with nearby trees)	55.18616	-3.08885
Figure 37	Measures to reduce surface runoff from track	55.185787	-3.084923
Figure 41	Fish easement - difficult towing to causeway track above	55.185678	-3.077052

Figure 42	Seek removal of rubbish from bankside	55.1863	-3.076835
Figure 45	Seek retention of bankside trees during harvesting operations	55.18935	-3.072395
Figure 46	Install Woody material	55.190138	-3.072103

5. Further assistance

The WTT may be able to offer further assistance such as:

- WTT Practical Visit
    - Where recipients require assistance to carry out the improvements highlighted in an advisory report, there may be the possibility of WTT staff conducting a practical visit. This would consist of 1-3 days' work, with a WTT Conservation Officer(s) teaming up with interested parties to demonstrate habitat enhancement methods (e.g. pinned woody material, willow planting, willow laying, etc.). Please contact your local WTT Conservation Officer for further information.

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

www.wildtrout.org/content/wtt-publications

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 populations and managing invasive species.

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

6. Acknowledgements

The WTT would like to thank the Environment Agency (Scottish Borders) and William Grant Foundation for supporting our advisory and practical visit work in Scotland.

7. Disclaimer

This report is produced for guidance; no liability or responsibility for any loss or damage can be accepted by the Wild Trout Trust as a result of any other person, company or organisation acting, or refraining from acting

upon guidance made in this report.

Legal permissions must be sought before commencing work on site. These are not limited to landowner permissions but will also involve regulatory authorities such as the Scottish Environment Protection Agency, local Council – and any other relevant bodies or stakeholders. Alongside permissions, risk assessment and adhering to health and safety legislation and guidance is also an essential component of any interventions or activities in and around your fishery.

Appendix

In addition to the general land management recommendations like fencing/livestock exclusion, simple in-channel habitat improvements could be initiated through the installation of woody material techniques. The prime location for this would be the significantly straightened and uniform capacity sections of channel, where both of the following techniques would be suitable for installation during a woody material workshop. The absence of any sensitive infrastructure in the valley means that flood risk is not an issue.

Lodged Woody Material, replicating the natural occurrence of trees and limbs lodged against or between standing trees and Pinned Woody Material, which replicates trees and branches that come to rest in the river margin.

Lodged Woody Material

Figure 47. Lodged woody material flow deflector. Note how the two upright sycamore stems lock the pole in place. The more pressure that is exerted by flow, the greater the friction becomes. This cannot wash out unless the well-rooted supporting trees give way, which is highly unlikely.

Figure 48. Another variation of lodged woody material, or hanger. This technique is equally secure as the standard lodged woody material. A hybrid of the two techniques can also be applied – demonstrated here during a previous habitat workshop on the River Esk catchment.

Figure 49. As demonstrated here, lodged woody material is a regular, natural occurrence too.

Pinned Woody Material

Figure 50. Woody material securely pinned in place with sturdy stakes. The benefit of this technique is that it can be used without nearby trees as an anchor point. Posts (white ellipses) are driven into the bed and/or bank to secure the material, with the butt ends u/s, as material would usually come to rest. Utilisation of this technique is usually in more sheltered inside bends, where it can be incredibly effective at increasing sediment deposition to reshape an over-capacity channel.

Tree hinging

Where low and trailing tree cover is lacking, and multiple trees of suitable species are present, the occasional trunk can be cut and hinged to create an enhancement feature, with no significant detriment to the overall habitat and would be valuable wherever a lack of low or trailing cover is identified. The technique entails cutting partially through the trunk, so that it remains attached but can be hinged over, into or along the channel (Figure 51). It works particularly well with willow, elm, thorns (hawthorn or blackthorn) and hazel, but only willow will thrive with its canopy partially submerged.

Figure 51. Willow hinged into the river margin to increase cover and structure. The method involves cutting part way through the stem, quickly through the first two thirds, then continuing until it collapses or can be pushed down over the river. The depth of the cut should be limited to only that which is required to bend the stem over, as this will maintain maximum size and strength of the hinge and the health of the tree/shrub.

Willow whip planting

Selective planting of willows as whips/cuttings would be useful at any open locations that lack tree cover; on the inside of bends to encourage deposition or on the outside of bends to create cover feature trees or drive bed scour. Being fast growing and easy to establish, willow planting could rapidly increase cover and provide material to be hinged into the channel in later years.

The easiest way of establishing new willow saplings is by pushing sections of freshly cut whip or branch into areas of wet ground, ideally around the waterline where there is plenty of moisture available. Whip planting can be undertaken at any time of the year but will have the greatest success during the dormant season, shortly before spring growth begins (ideally late Jan-March).

Whips should be planted so that the majority (~2/3) is within the ground, to minimise the distance that water has to be transported up the stem initially, before a substantial rootstock develops. Planting on a shallow d/s angle eases water transport within the developing tree (which starts without any root) and reduces the potential for it to catch flood debris and be ripped

out. Leaving 300-400mm of whip protruding from the ground is usually sufficient, providing they protrude well past the surrounding vegetation (to allow access to light). Whips of 5mm-25mm diameter tend to take best, but even large branches can be used. If undertaken during the growing season, care should be taken not to use whips with excessive foliage, which greatly increases the rate of transpiration and can lead to the whip dehydrating before the supporting root system develops.