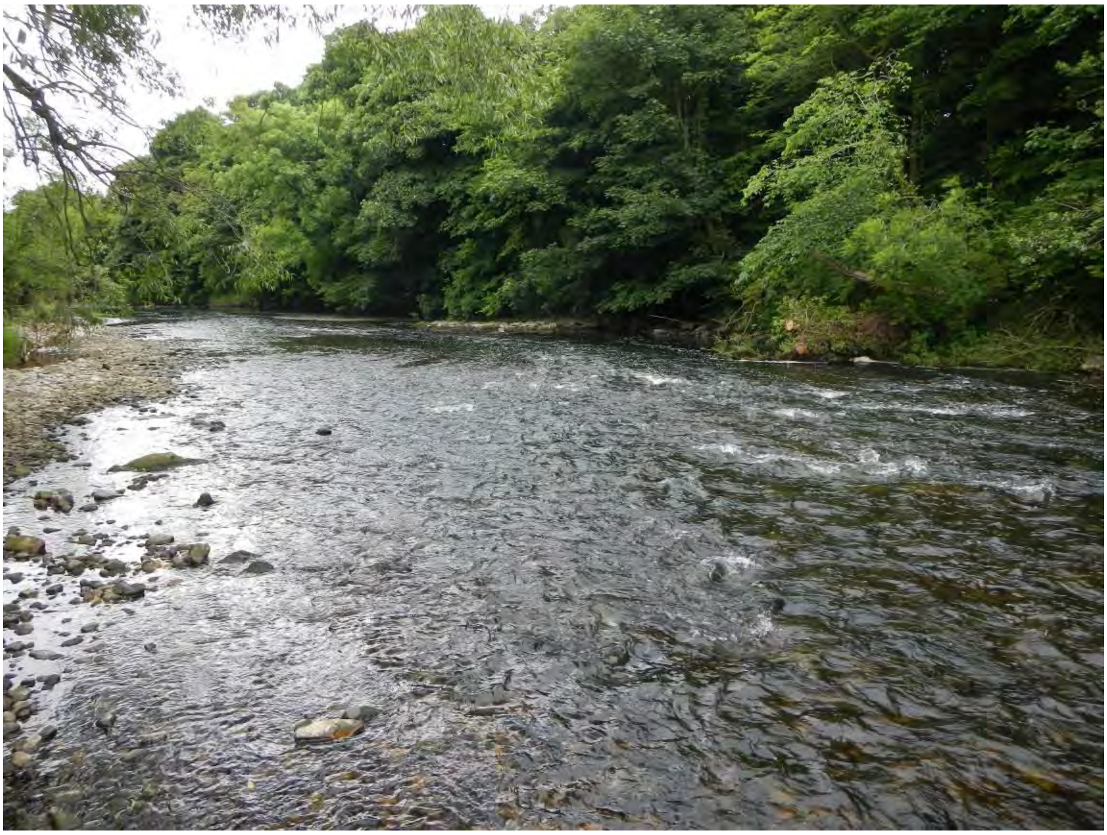
Advisory Visit

River Wear

Willington and District Angling Club

24/06/2016



Key Findings

- The channel in this section of River has been subjected to significant realignment and modification over the years but is already naturally recovering and will continue to do so over time, providing that it is managed sympathetically.

- Features such as fallen trees and low, trailing branches increase flow diversity and will assist/accelerate natural recovery of the channel by facilitating a greater occurrence of scour and depositional features. Removal of such features should therefore be ceased and promotion of those features through planting and tree laying undertaken instead.

- In addition to assisting the channel recovery, increasing the occurrence of low-level and trailing cover will provide more trout habitat and increase the number of fish that the River can produce and hold.

- Despite the negative impacts upon the River, the habitat it currently provides is already capable of supporting healthy wild populations and a viable trout fishery (as demonstrated by catch returns and observations during the visit). Some minor habitat work will improve the fishery further.

1.0 Introduction

This report is the output of a site visit to Willington and District Angling Club (W&DAC) waters on the River Wear, up and downstream of Jubilee Bridge. The visit was undertaken by Gareth Pedley of the Wild Trout Trust (WTT) and was initiated following an approach to the WTT from Shaun O'Dowd (Club secretary). The purpose of the visit was to assess habitat on W&DAC waters and advise on potential options that could be undertaken to improve the fishery to the benefit of wild fish populations.

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. This report covers observations made on the day of the visit and discusses options for future management.

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

	Waterbody details
River	Wear
Waterbody Name	Wear from Gaunless to Browney
Waterbody ID	GB103024077464
River Basin District	Northumbria
Current Ecological Quality 2015	Moderate
U/S Grid Ref of reach inspected	NZ 19943 33255
D/S Grid Ref of reach inspected	NZ 23057 35424
Length of river inspected (km)	5

(http://environment.data.gov.uk/catchment-planning/WaterBody/GB103024077464)

Under the Water Framework Directive (WFD) classification, most of the parameters assessed for the waterbody are 'Good', 'High' or 'Supports Good'. However, the classification for surface water is only 'Moderate' which lowers the overall classification to 'Moderate' as it is the lowest score which dictates the outcome.

2.0 Catchment / Fishery Overview

This area of the River Wear supports a range of fish species, both coarse (primarily chub *Squalius cephalus*, barbel *Barbus barbus* – observed during the visit) and salmonid (resident trout *Salmo trutta*, grayling *Thymallus thymallus*, and migratory sea trout *Salmo trutta* and salmon *Salmo salar*), along with other species less relevant to the W&DAC's angling interest. For a broader overview of the catchment, several other reports for the River Wear can be viewed on the WTT website.

W&DAC allow a range of angling methods, with some restrictions on timing and exact methods to be used, with a requirement that all trout and grayling fishing be undertaken with barbless hooks. The Club currently stocks with 500 triploid brown trout, the capture of which, along with any other fish, is recorded within the Club logbooks to inform future stocking and fishery management practice. Such records suggest that the majority of anglers already release a large proportion of the fish that they catch (Shaun O'Dowd, pers. comm., June 2016).

The section of River inspected (u/s and d/s of Jubilee Bridge) is one of two sections of the River Wear controlled by the club, the other being much further u/s at Eastgate. Walkover of the section was conducted in two phases but for continuity of the report will be covered from the d/s limit, working u/s.

3.0 Habitat Assessment

Around the d/s limit, the channel appears quite uniform and over-capacity, with a general lack of in-channel features; this, along with the straight, relatively incised nature of the channel and lack of sinuosity strongly suggests past channel realignment and maintenance/dredging activity (Fig. 1). The presence of at least three separate bunds along the RB provides further evidence of past channel engineering having been undertaken (Fig. 2).

Despite a history of modification, the formation of gravel bars on the inside of bends indicate that the channel is recovering over time. This process is greatly assisted by natural structures within the channel that encourage areas of scour and deposition and is one of the many reasons that trees and branches that fall or protrude into the channel should be retained. Such features can even be created; for example, by laying the large willow on the inside of the bend (Fig. 2) into the channel. This utilisation of natural processes would help to narrow the channel, encouraging further deposition on the inside of the bend and increasing flow velocities within a narrower self-maintaining channel.

Destabilisation of the RB, as a consequence of past grazing, is likely to have inhibited natural narrowing and recovery of the channel; however, livestock are now excluded from the riverbank with an electric fence and vegetation is free to colonise any depositional features within the river margin, helping to consolidate those features and naturally adjust the channel dimensions.

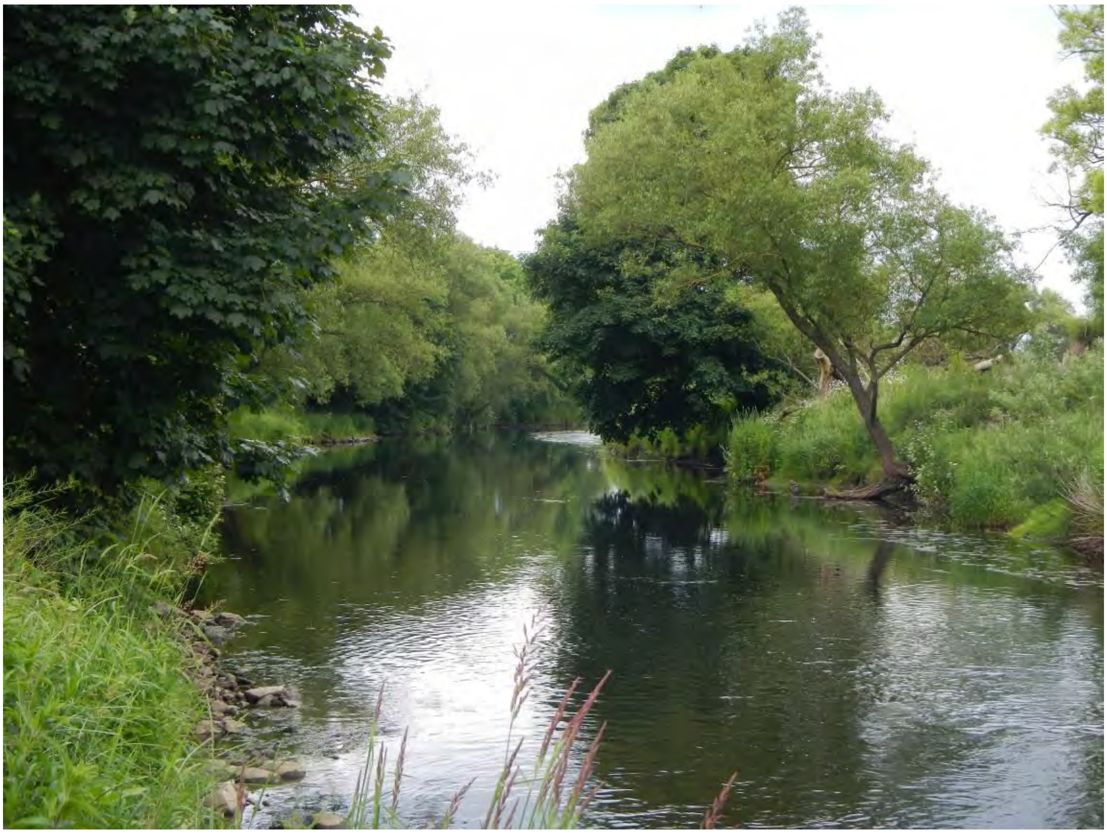


Figure 1. Relatively featureless, over-capacity channel. The area is beginning to naturally recover but the process could be accelerated by increasing structure within the channel to facilitate additional scour and deposition. The willow (right of shot) could be laid into the river margin to assist the process.

Channel maintenance that was once widespread throughout the catchment has now stopped in most locations. Current best practice is more likely to focus around the development of natural channel dimensions and features that will assist transportation of substrate, rather than dredging to create an over-capacity channel that leads to increased deposition and a requirement for more dredging.

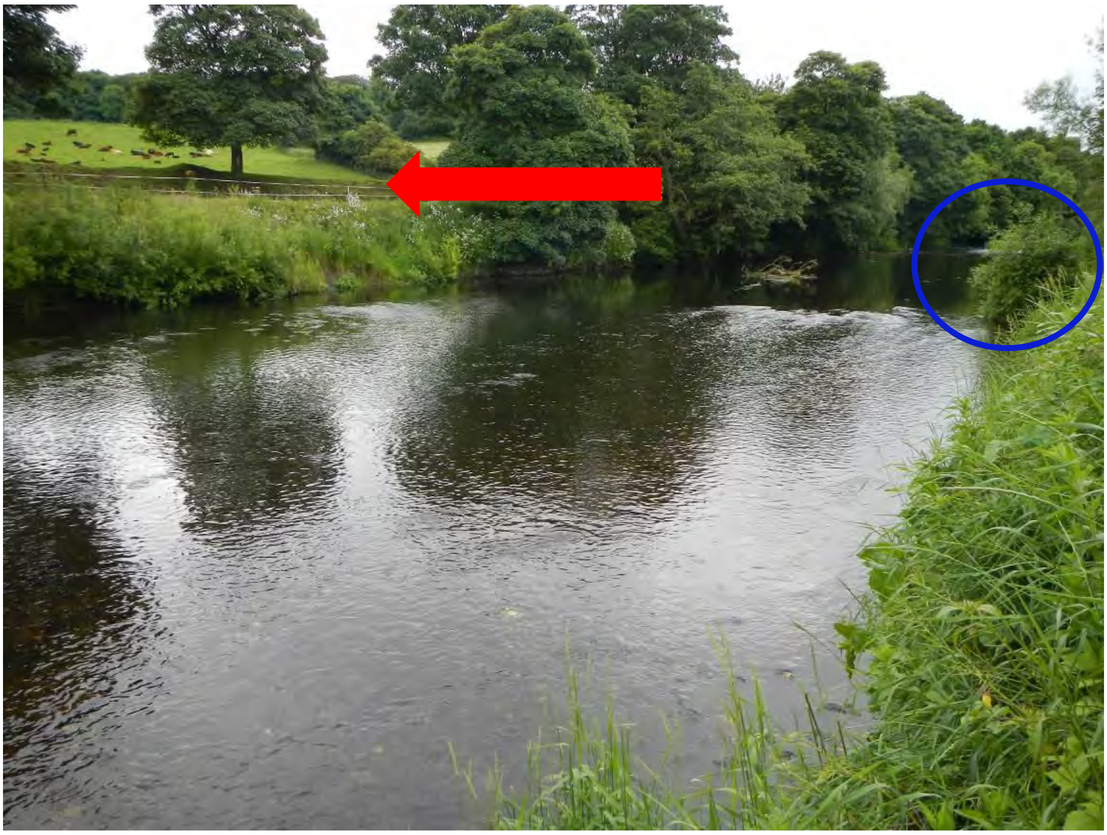


Figure 2. Looking u/s at an overly uniform but recovering channel section. Note the flood bunds along the far bank (red arrow). Given time, the small willow on the true LB (blue circle) will further help to diversify the channel, encouraging deposition in the river margin and diversifying the topography of the bed, providing it is allowed to grow and is not pruned.

Page Bank Beck, a small, heavily dredged and straightened tributary, joins the River at NZ 23039 35412 and provides some potential for spawning (suitably sized substrate present and salmonid fry observed), although past and ongoing channel maintenance is severely limiting its potential (Figs. 3&4). Allowing gravel bars and natural vegetation to establish within the channel would naturally narrow areas and facilitate scouring and sorting of the substrate, possibly assisted by the use of flow deflectors. Whether the channel will be allowed to naturalise and whether features can be installed to facilitate gravel sorting will have to be agreed with the tenant/landowner.

Progressing u/s on the Wear, the channel diversity improves, with valuable overhanging tree cover and shallower riffle and glide habitat suitable for juvenile salmonids becoming available (Figs. 5&6). Bedrock in this area will have limited the extent of channel alteration and bed lowering and allowed for a more rapid natural recovery.

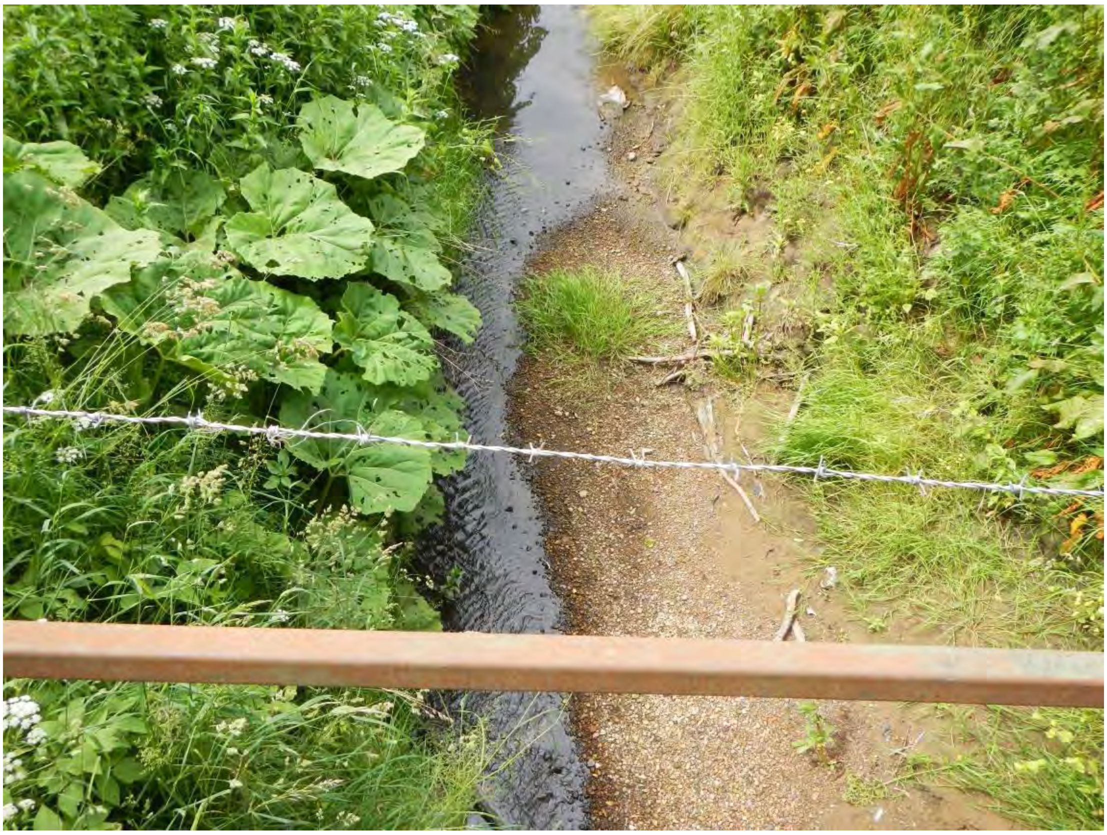


Figure 3. Small, heavily dredged and straightened tributary. Even since the last dredging activity a gravel bar is already forming naturally, evidence of its ability to recover if the unsympathetic maintenance is stopped.

Figure 4. Long, over-capacity sections of the tributary are punctuated with small depositions of gravel. These are signs of some natural recovery and are features which could be enhanced to improve the potential for salmonid spawning.

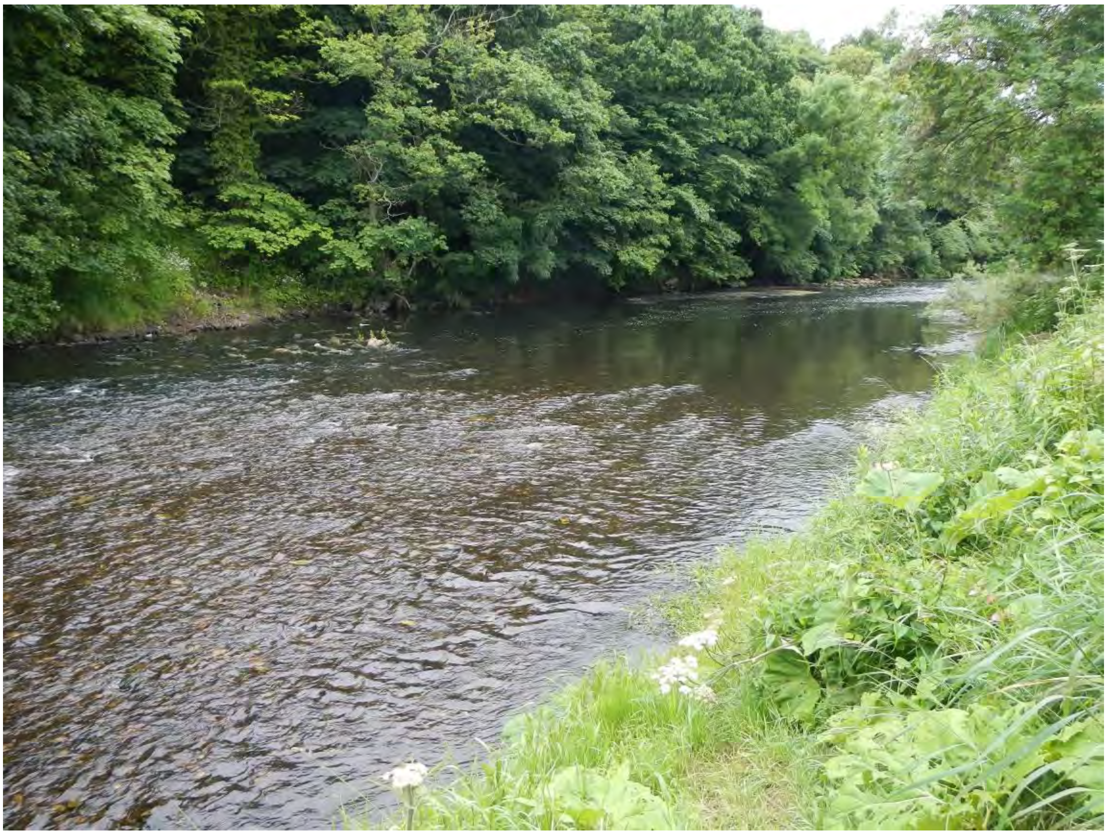


Figure 5. Bedrock has limited the extent of channel modification in some areas and, as a consequence, those areas provide more diverse, higher quality habitat that caters for the full range of salmonid life stages.

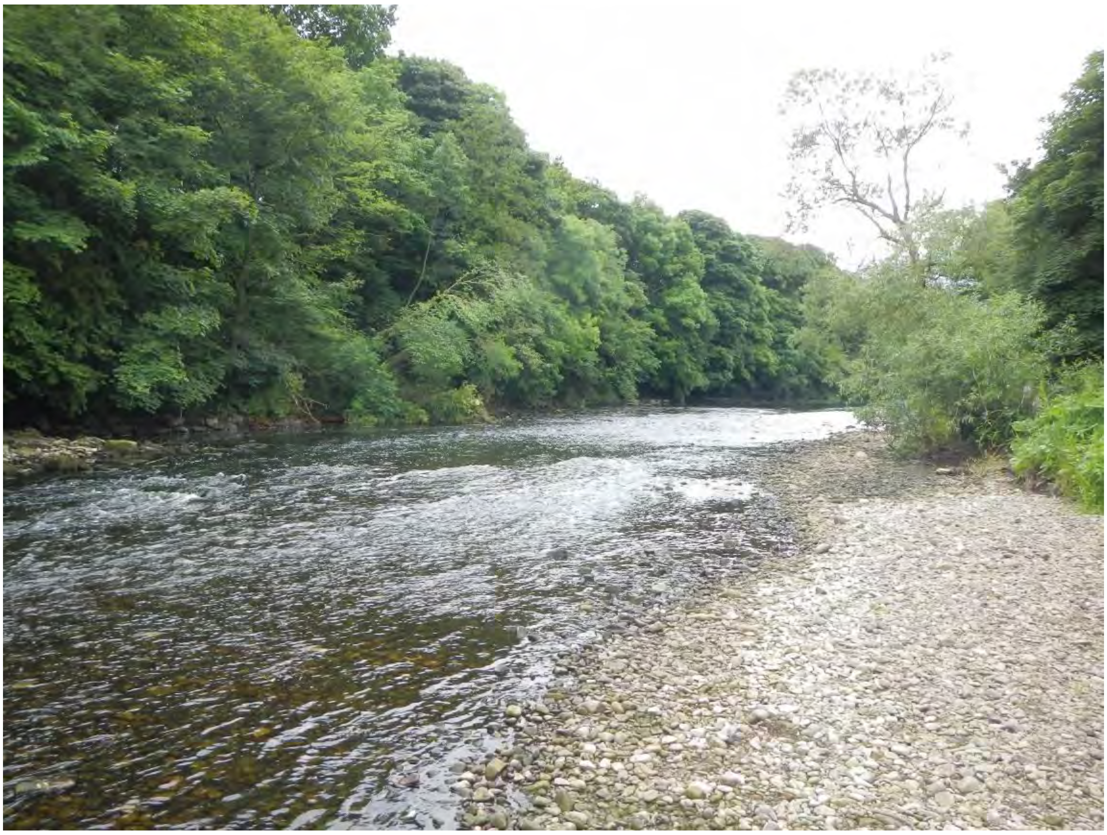


Figure 6. High quality riffle and glide habitat. Note how the presence of willow shrubs on the inside of the bend are likely to have assisted formation of the gravel bar - this naturally narrows the wetted channel, maintaining beneficial bed scouring and water depth.

Japanese knotweed *Fallopia japonica* was noted at NZ 22885 34990 and is a particularly detrimental non-native invasive species that shades out native plants. Knotweed dies back in the winter, leaving bare, exposed soils that are highly susceptible to erosion. The coverage currently appears limited to this one area and it should be treated with herbicide by qualified personnel to prevent its spread. Himalayan balsam *Impatiens glandulifera* was also noted throughout the visit and also requires treatment but, being so extensive within the catchment, is likely to require a more strategic approach. Wear Rivers Trust may be able to assist with both of these issues.

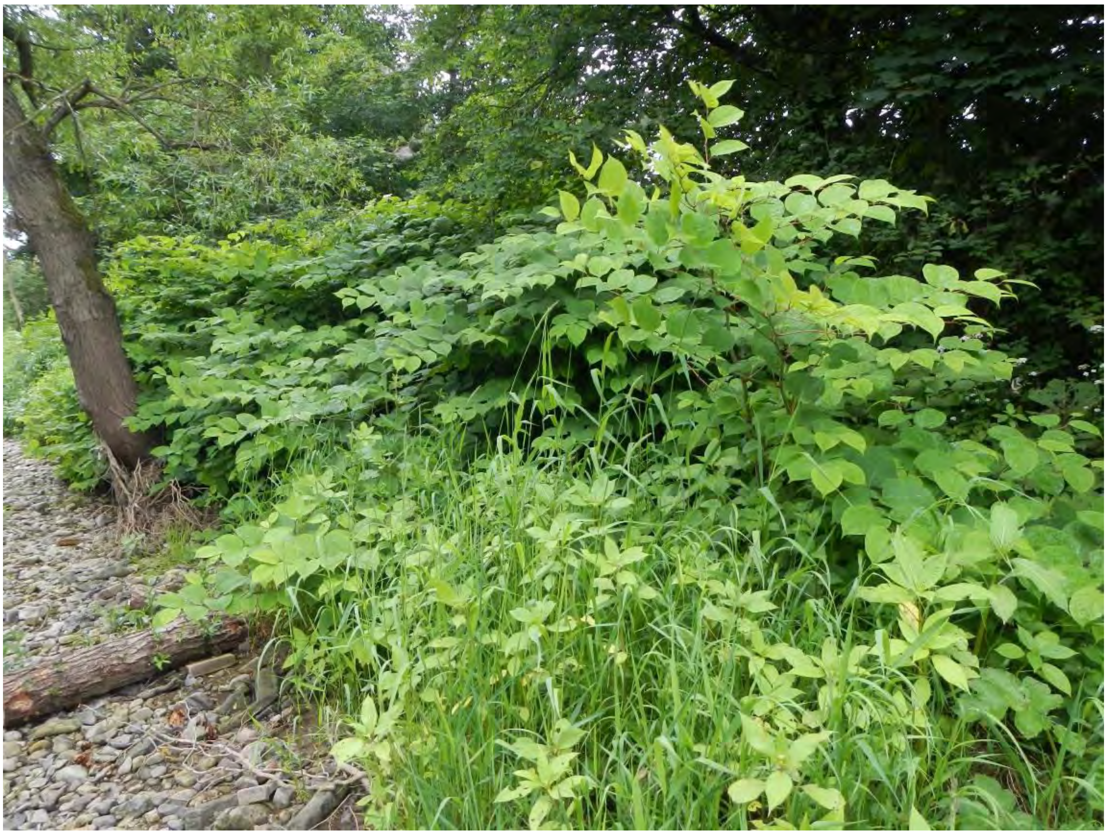


Figure 7. Japanese knotweed was observed at NZ 22884 34998. This appeared to be a relatively localised infestation and should be treated with herbicide before it spreads.

A short distance u/s, at NZ 22550 34808, the outflow from a small pond presents a point source of fine sediment (Fig. 8). It would be well worth investigating why fine sediment is emanating from the outfall and whether it can be prevented. While small sources of fine sediment may appear innocuous, any inputs to the River (particularly if occurring at low flows) can be detrimental. Fine sediment inputs can smother the coarse river substrate, reducing its potential as fish spawning and/or invertebrate habitat. Such outfalls are also often a source of excess nutrients that lead to deterioration of river water quality and issues like excess algal growth.

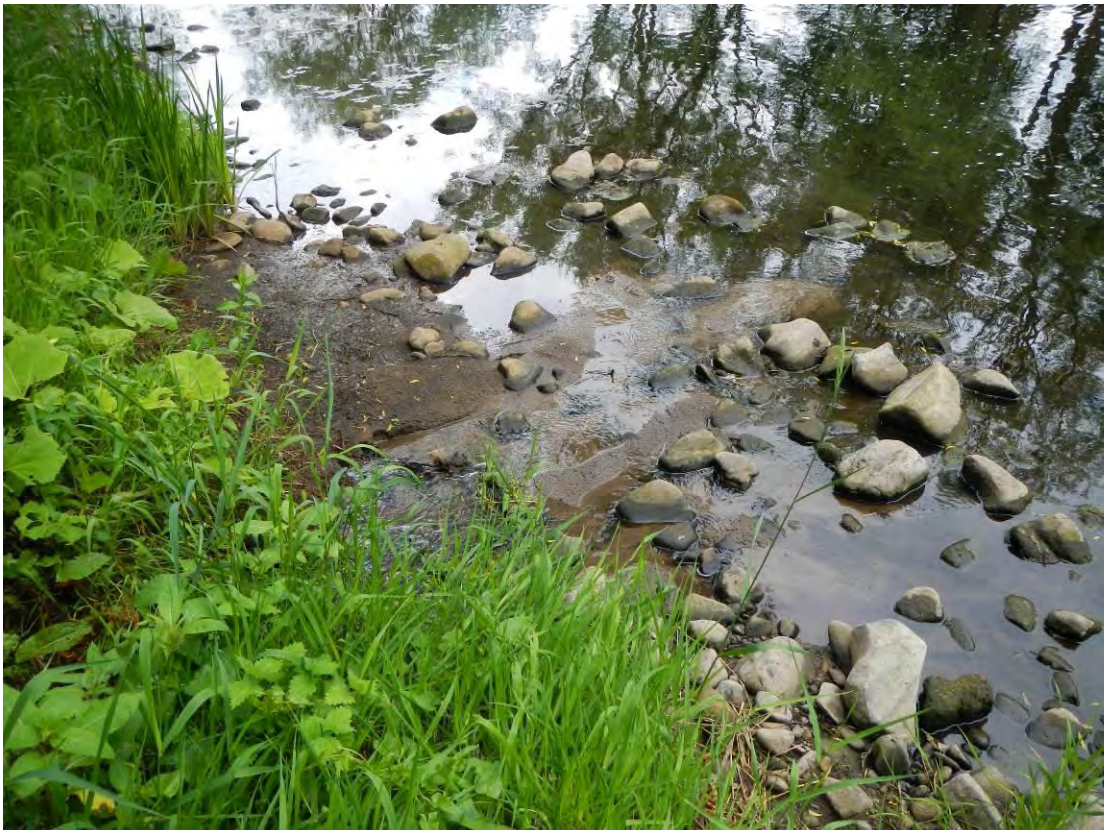


Figure 8. Any sources of fine sediment input to the River should be investigated and, wherever possible stopped to protect fish spawning and invertebrate habitat.

Livestock are excluded from the banks of the River in most areas and, as a consequence, the bankside vegetation and tree cover provide high quality habitat. However, where grazing is allowed, even at relatively low density, the impact can be seen (Fig. 9). There is a general lack of species diversity, other than grasses (which can withstand continual grazing) and unpalatable species like docks *Rumex* spp. Trampling damage and a lack of diverse vegetation has led to bank erosion, significant channel widening and an associated loss of water depth. The lack of bankside trees, particularly trailing branches, also leaves a distinct lack of cover along the LB. Livestock trampling around one of the few remaining bankside shrubs further demonstrates how grazing can denude a bank of such features (Fig. 10) - it too will be lost through wash-out in subsequent floods if the bank is not allowed to revegetate and stabilise around it.

Grazing of the area is also inhibiting vegetation from colonising and stabilising the gravel bars along the left bank. This maintains them in an unstable state and susceptible to movement in high flows. Excluding livestock from the river bank would allow a naturally diverse range of vegetation to become established along the bank and create an area that could be replanted with trees, both of which would greatly reduce the bank erosion and facilitate natural channel narrowing to occur.

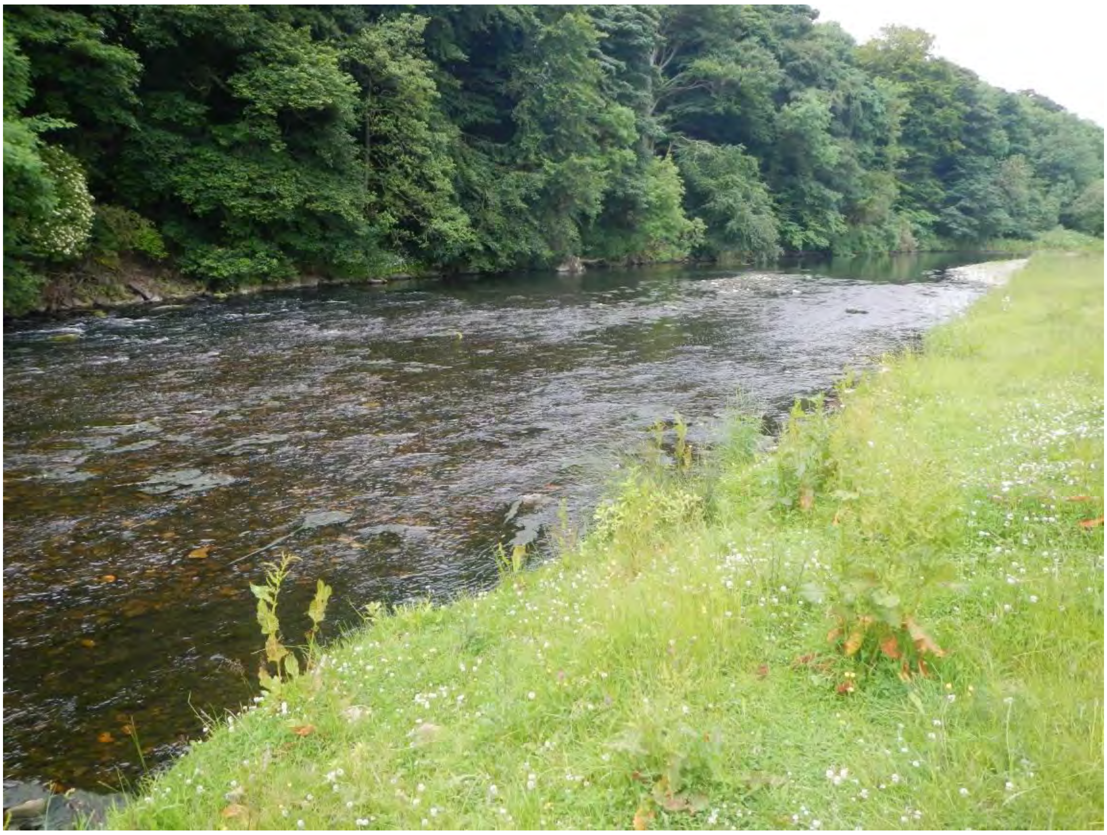


Figure 9. Long-term grazing of the LB (right of shot) has greatly denuded it of its natural, diverse vegetation and trees, reducing the availability of cover and the River**'s natural ability** to adjust its channel dimensions.

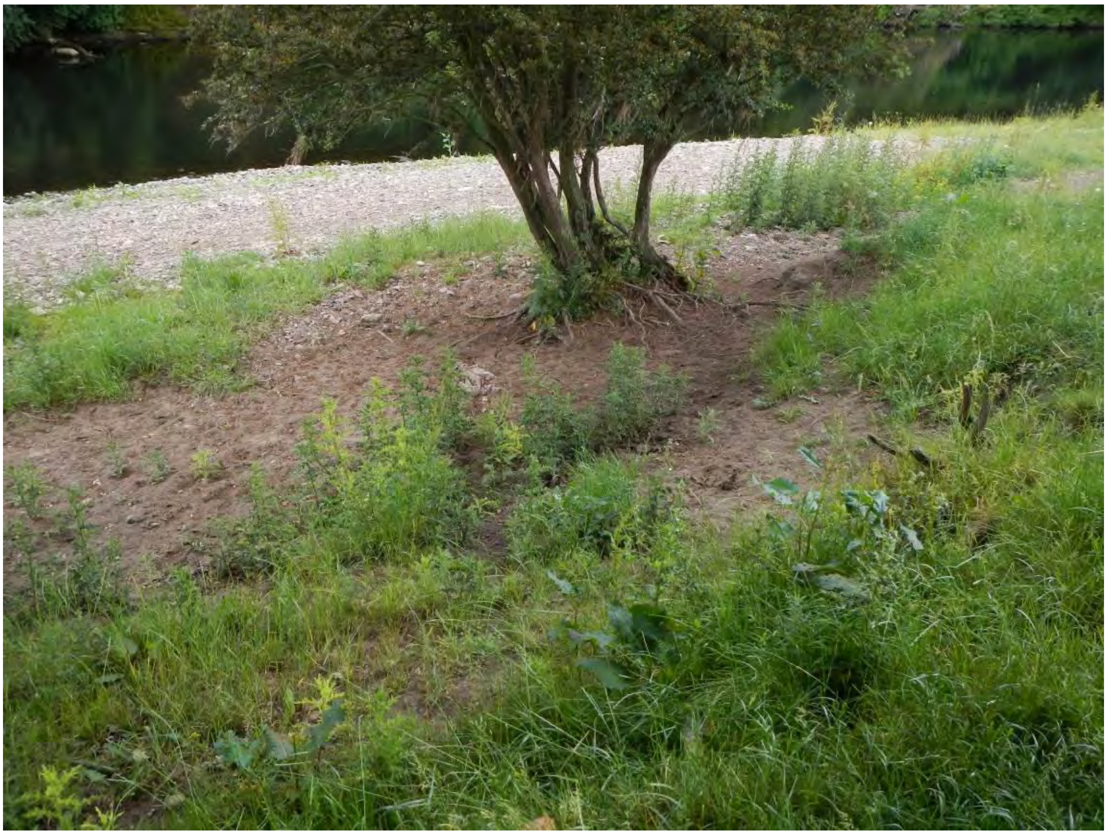


Figure 10. A perfect example of how, over time, river bank grazing leads to loss of not only herbaceous vegetation but also shrubs and trees. Unless the ground around this hawthorn *Crataegus monogyna* is allowed to re-vegetate, it is highly likely that further erosion in high flows will wash it away.

An obvious area of more recent channel realignment is evident a short distance upstream, where a large natural meander has been replaced by a straight section of channel (Figs. 11 & 12). This has extended the shallow character of the River even further upstream. Boulder/stone weirs extend across the channel at either end of the straightened section, probably installed in an attempt to de-energise flows and retain the River in its manmade channel.

As with all weirs, these structures act as sediment traps and lead to shallowing of the channel upstream, encouraging relatively uniform deposition of substrate across the bed. Leaving at least a one-third channel width gap would have reduced the impact of shallowing by allowing transport of sediment through the central notch. Correspondingly, removing at least the central third of the weirs would allow the development of a more natural channel morphology. Ideally, however, the whole structures would be removed after first installing buffer fencing to allow herbaceous vegetation and trees/shrubs to consolidate the banks.

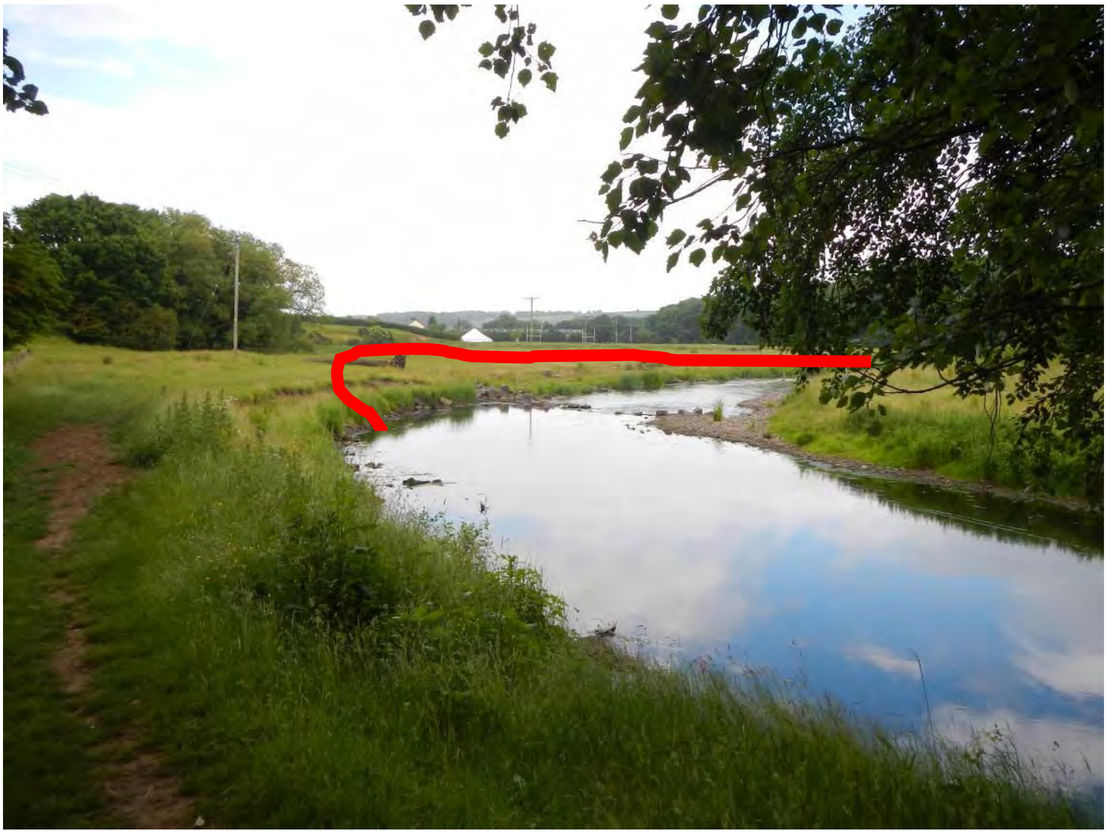


Figure 11. Looking d/s at the current channel and old course of the River (red line).

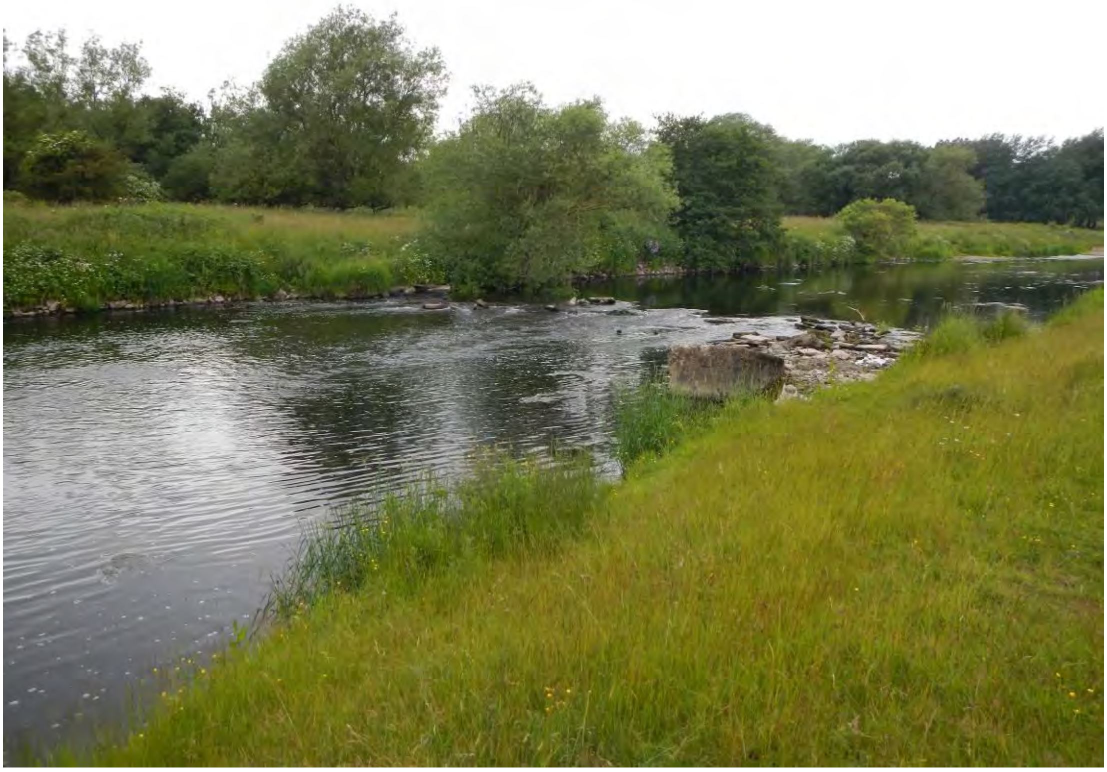


Figure 12. Weirs form sediment traps and while they may initially increase water depth upstream through their impoundment, they will ultimately lead to a decrease in depth over time as the river bed material supplied from upstream gradually accumulates within the impounded section. The impoundment and reduced substrate movement (scour and deposition) within the impounded reaches also limits flow diversity and inhibits the formation of beneficial habitat features. Note the wide, shallow section u/s.

A similar weir further u/s has begun to wash out in the centre, reducing the negative impact of that structure although not completely, with the channel u/s still impounded and natural sediment transport inhibited by the impoundment and the structure.

Habitat u/s of the weir is, however, greatly improved by the presence of a large willow shrub that has fallen into the River, creating highly beneficial in-channel cover and narrowing the channel to increase flow velocities (Fig. 13). It should be remembered that, in addition to providing great cover and shelter from high flows, the presence of such structures also provide vital refuge from, and hence reduce the impact of, predators. Planting willow in more open, featureless sections like that immediately u/s can thereby actually increase the number of fish than can be held within a reach.

Angling clubs often make the mistake of trying to remove fallen trees/branches and woody features from the River as they are seen as untidy and/or a potential snag. However, this should be avoided at all costs; the benefits of the habitat they provide will far outweigh any 'perceived' detriment. It is far better to have high quality habitat that is full of fish than easy access to poor habitat with very few fish.

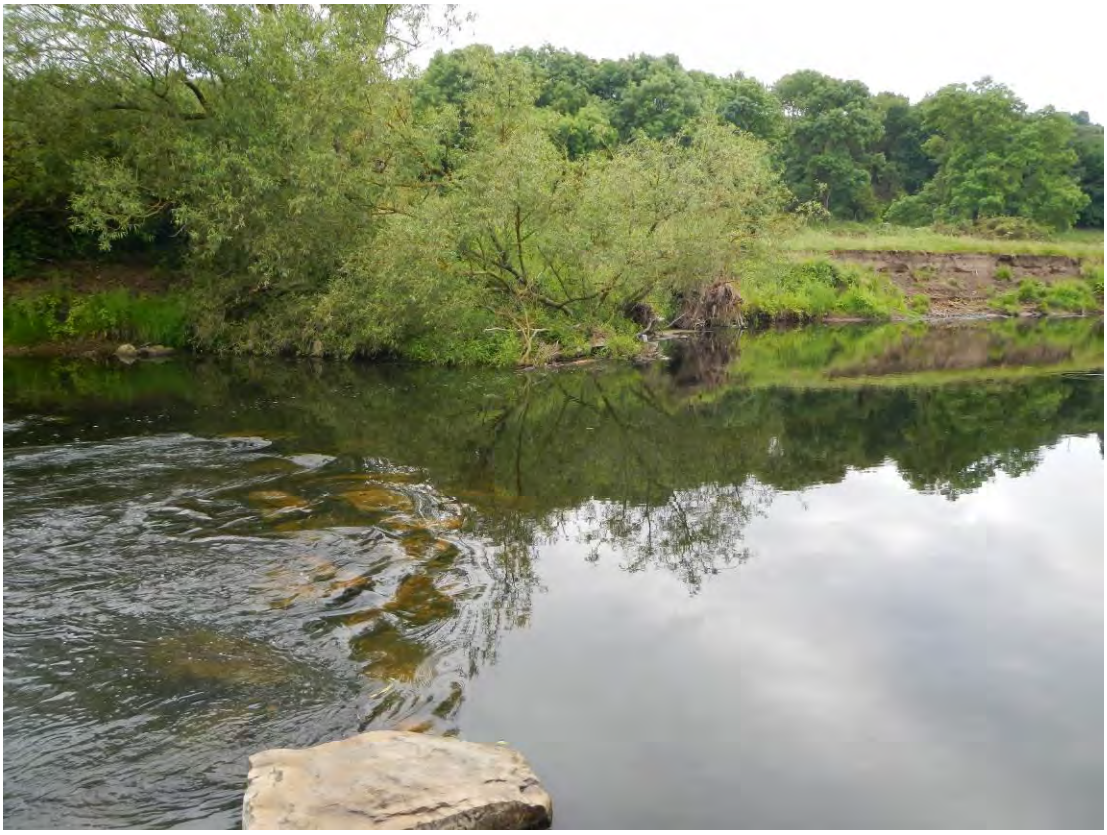


Figure 13. A degrading weir that still poses a negative impact through its impoundment and the associated disruption to sediment transport. A fallen willow u/s does, however, provide some habitat enhancement and is exactly the type of feature that should be promoted.

At NZ 21077 34454, an outfall from the sewage treatment works (STW) meets the River. While the water appeared to be relatively clean at the time of the visit, it is suspected that the discharge is often of a much poorer quality, as evident by the sewage fungus (grey) on the bed. The outfall should be regularly monitored and if discoloured or malodorous water is observed to be leaving the works, it should be reported immediately to the EA.

Immediately u/s of the outfall, a perfect example of the high quality habitat that can be achieved by allowing willow trees to naturally encroach into the River channel was observed (Fig. 14). The habitat provided by the trees is a major benefit in this area and, correspondingly, it is likely to hold good numbers of fish, both resident and migratory (at certain times of the year).

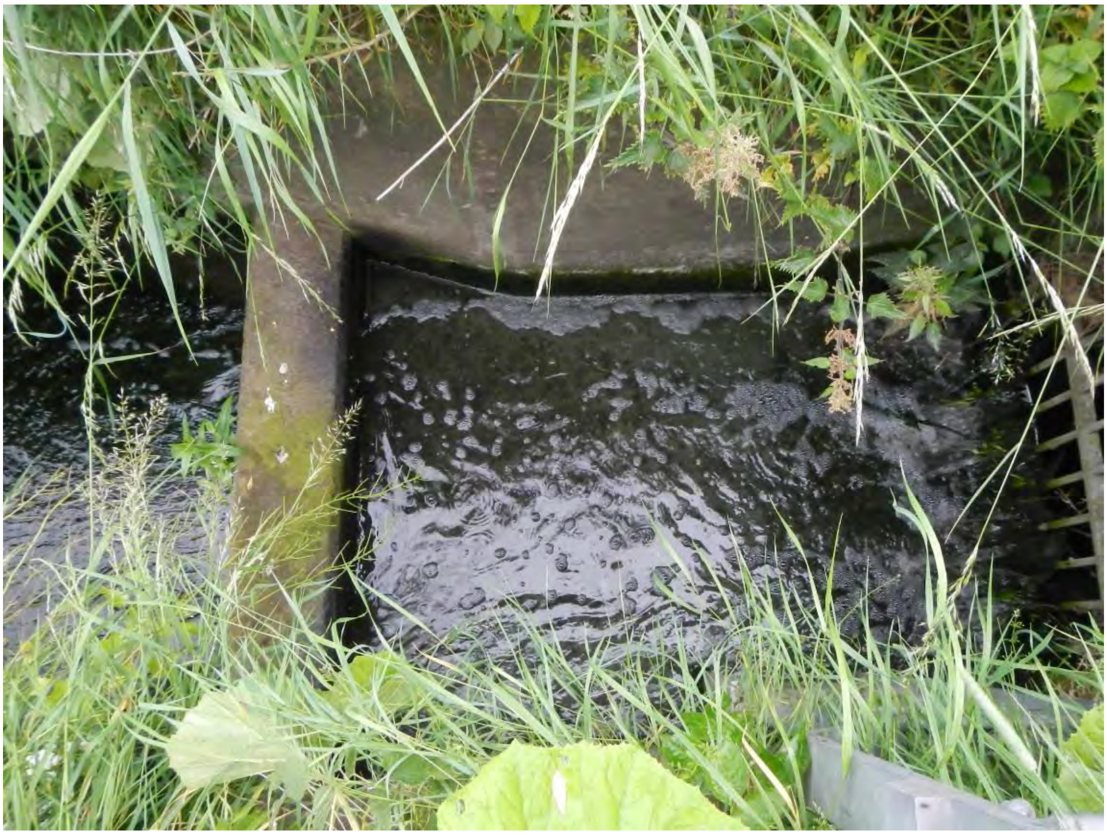


Figure 13. The STW outfall. Note the grey coating on the bed of the channel. This indicates high nutrient/poorly treated water emanates from the outfall at times – something that should be closely monitored, and reported when observed.

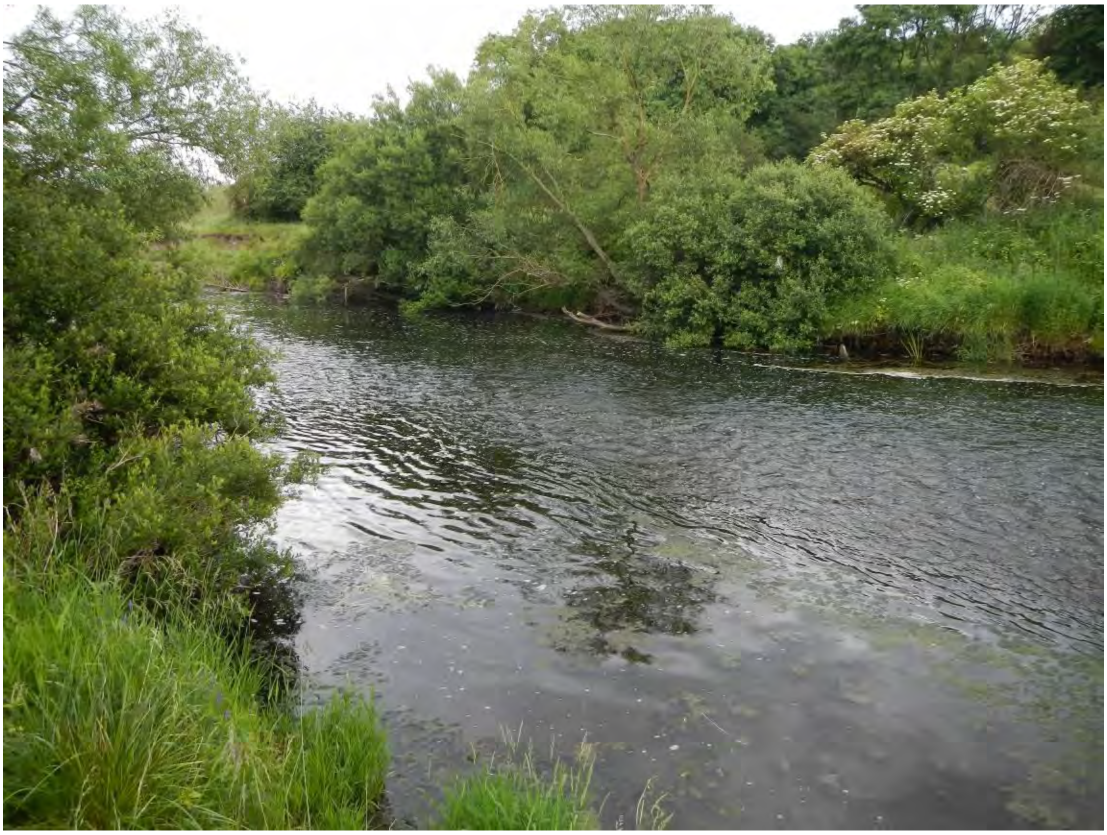


Figure 14. Very high quality wild trout habitat provided by a natural abundance of overhanging and, very importantly, trailing willow branches, coupled with diversely vegetated banks.

It is not only livestock access and trampling that can exacerbate bank erosion and the section adjacent to Jubilee Bridge carpark is a good example of this (Fig. 15). Here, human and dog access to the bank (coupled with Himalayan balsam growth) has led to erosion of the bank. Addressing the balsam issue and temporarily excluding access from that area of bank would allow the bank to revegetate and naturally regrade, making it far less susceptible to erosion. Formalising a revetted access point for anglers could also help.

The channel in this section is greatly over-capacity (probably due to dredging associated with the bridge) and so should not be susceptible to erosion if the banks can be allowed to revegetate. Aside from the riffle at the head of the pool, trailing willows on the far bank (RB) provide the only valuable habitat features for trout. Again, such features could be replicated along more open bank sections to increase the fish holding capacity - conversely, removing or pruning those features is sure to reduce the number of fish that reside there.

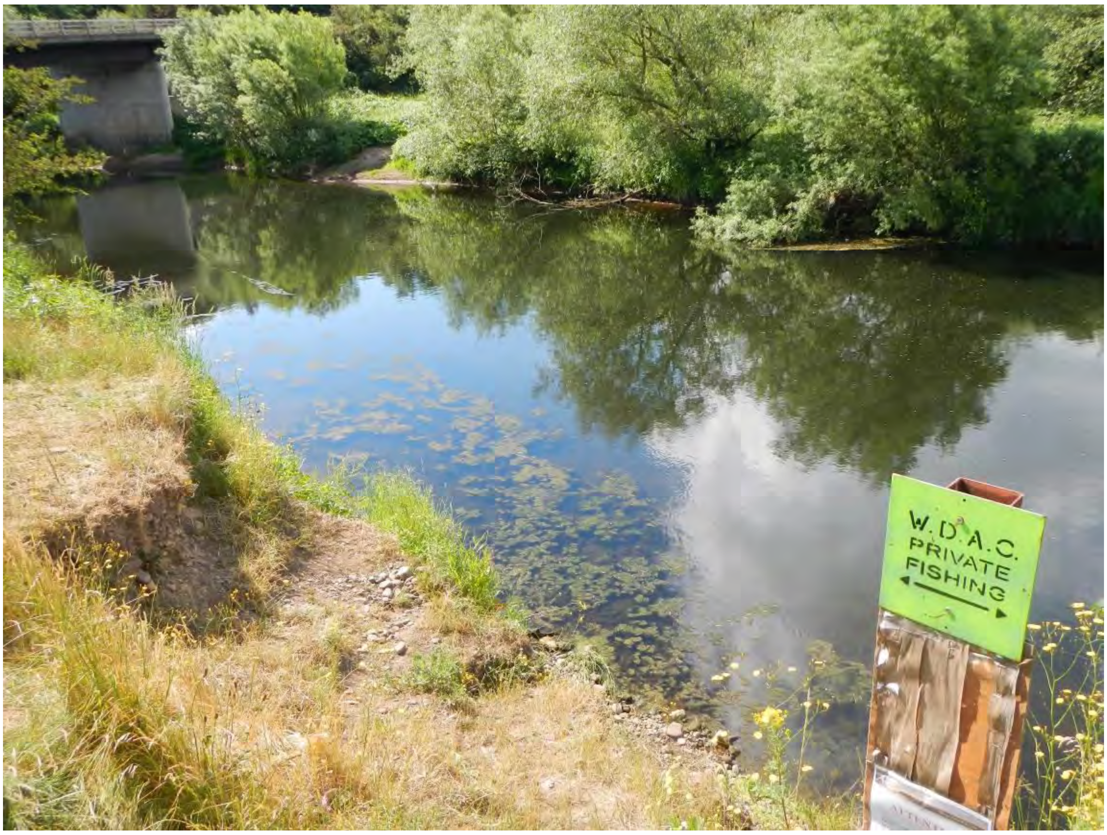


Figure 15. Bank erosion that is greatly exacerbated by trampling (human and dog) and Himalayan balsam.

Two other great examples of valuable, natural in-channel structure can be observed a short distance u/s; an alder tree that washed out in the recent floods (Fig. 16) and a large, collapsed willow limb (Fig. 17). Both of these features reduce channel capacity and increase flow diversity, creating beneficial bed scouring in some areas and deposition in others. They also provide habitat for plenty of fish!

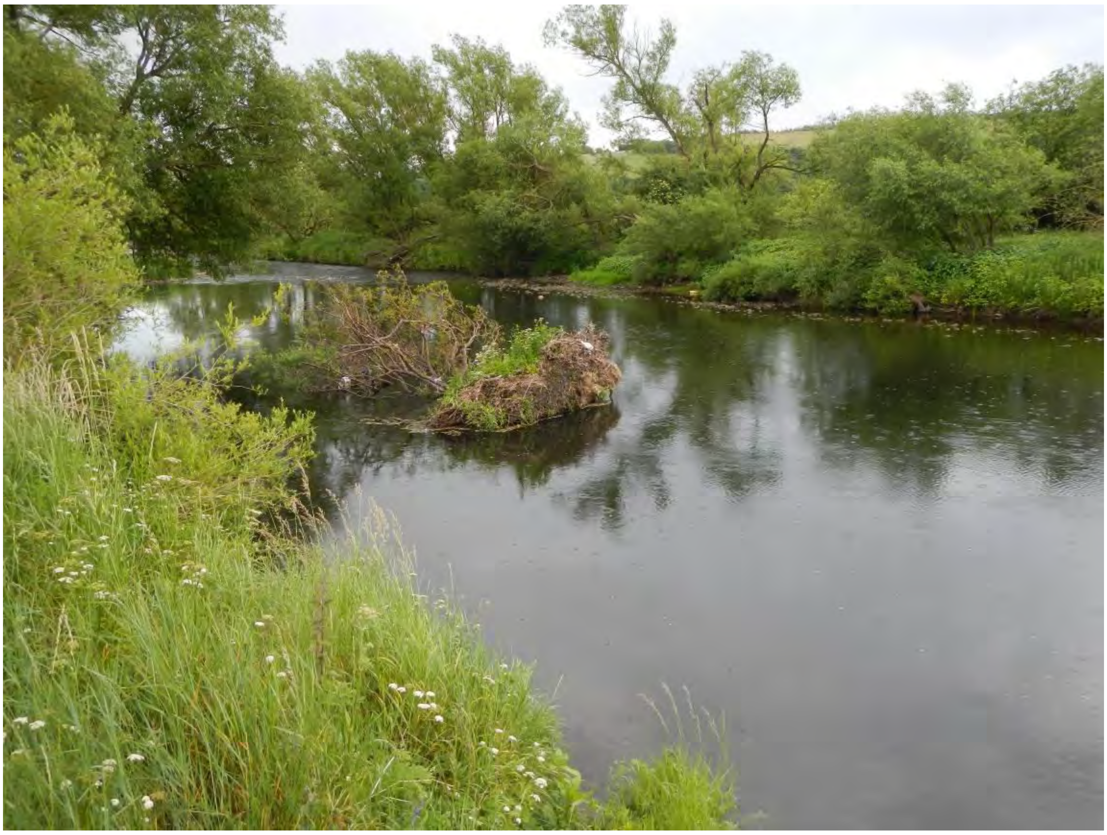


Figure 16. An alder tree that has been deposited towards the tail of a pool. This creates a beneficial feature that will hold more and bigger fish than would hold there before. Remove it and the River will be able to hold less fish.

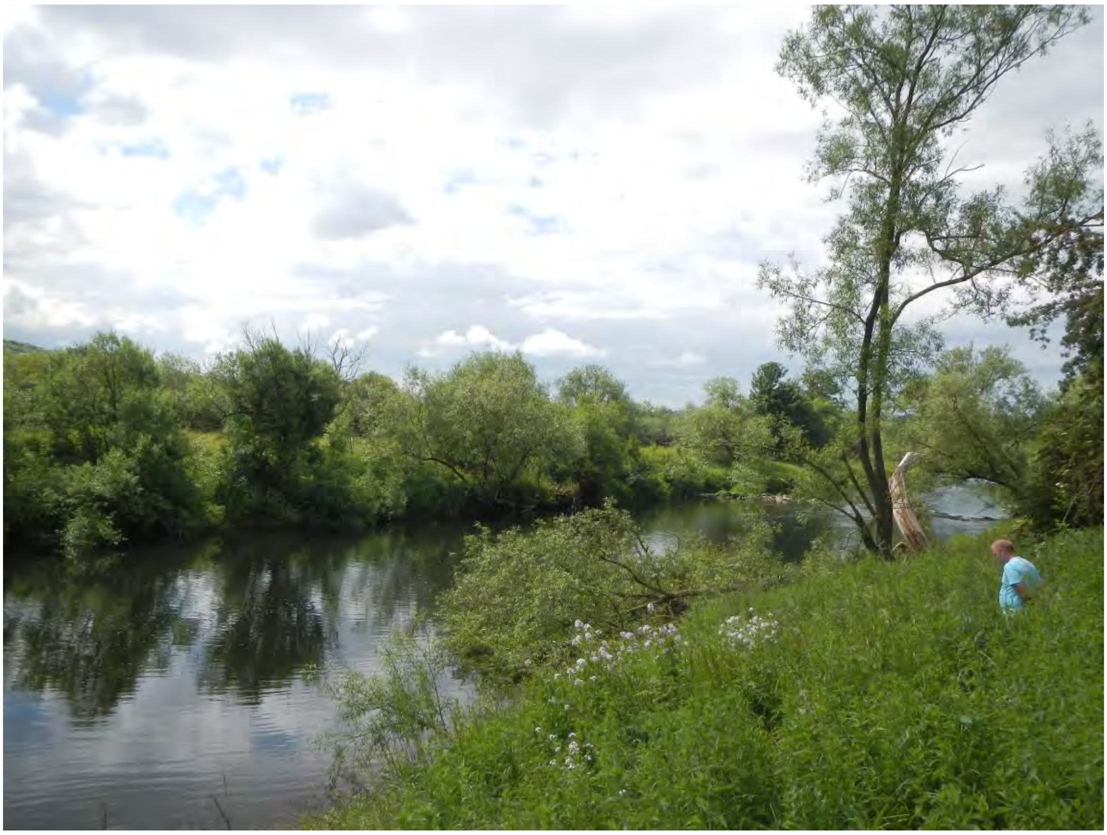


Figure 17. A collapsed willow limb provides valuable shelter and refuge for fish. In addition to these obvious benefits, the dissipation of flow energy along the LB margin will encourage deposition of gravel and other sediments among the structure and d/s of it. This will assist the natural channel narrowing process that will in turn help keep the bed of the remaining channel free from finer sediment and maintain the flow rate and depth of the remaining channel.

A weir at NZ 20234 34405 creates similar issues to those already discussed, but here, is also causing bank erosion as flows have cut around the structure (Fig. 18). Ideally the whole structure would be removed but removing at least the central third of the structure would reduce the pressure currently acting upon the bank and make any bank protection measures more effective. Filing the erosion void with material such as laid willow or live willow brash should help reduce flows and increase deposition there to fill the void.

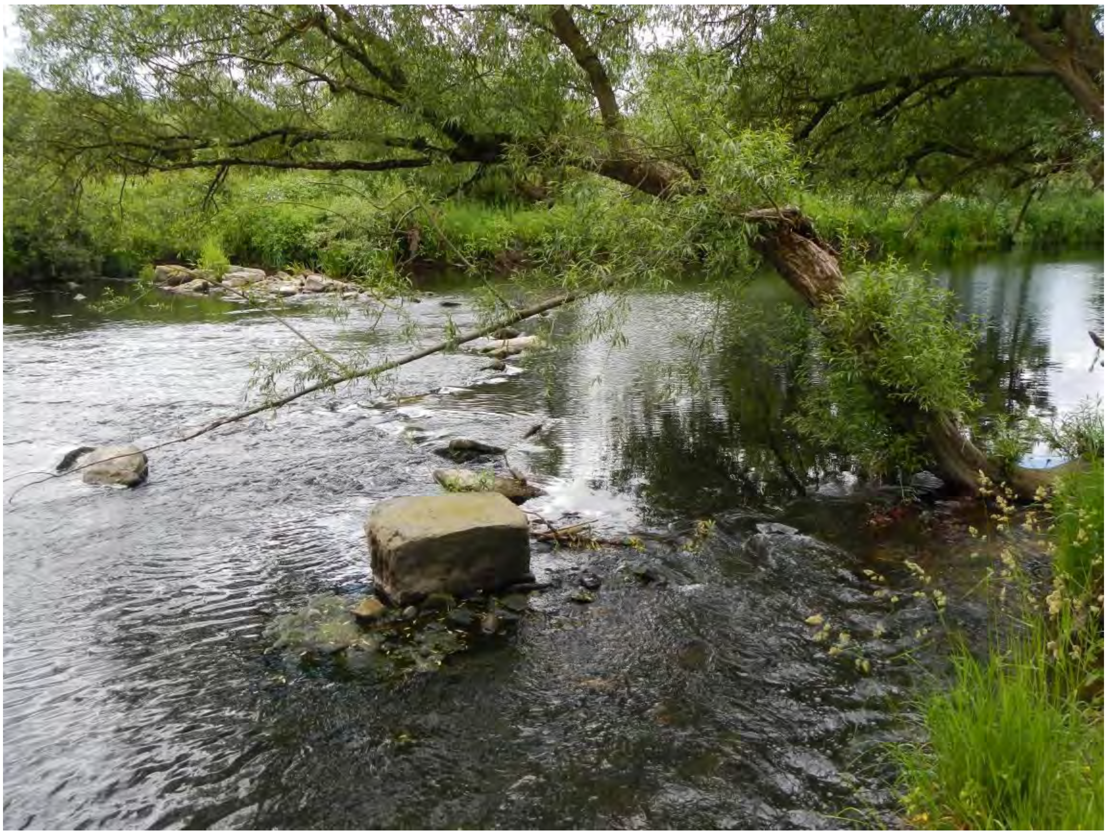


Figure 18. Bank erosion issues where another stone weir has been out-flanked by flows.

The sluggish, low quality habitat u/s of the weir (Fig. 19) could be improved by laying willow trees into the channel to recreate the narrowing and habitat enhancements provided by the naturally collapsed willow d/s. Again, this would also assist the development of greater river bed diversity. The benefits here too would be improved by removal of the weir as the River would then have a greater amount of flow energy with which to develop the channel.

A small section of tributary on the LB (NZ 19993 34112) offers some potential for salmonid spawning (Fig. 20), although it is greatly restricted by the presence of a culvert c. 35 metres u/s of the main River. The RB of the tributary is currently subject to significant erosion (associated with Himalayan balsam), which has allowed it to become over-wide and is reducing natural scouring of the bed that would otherwise help to maintain the gravel free from fine sediment.

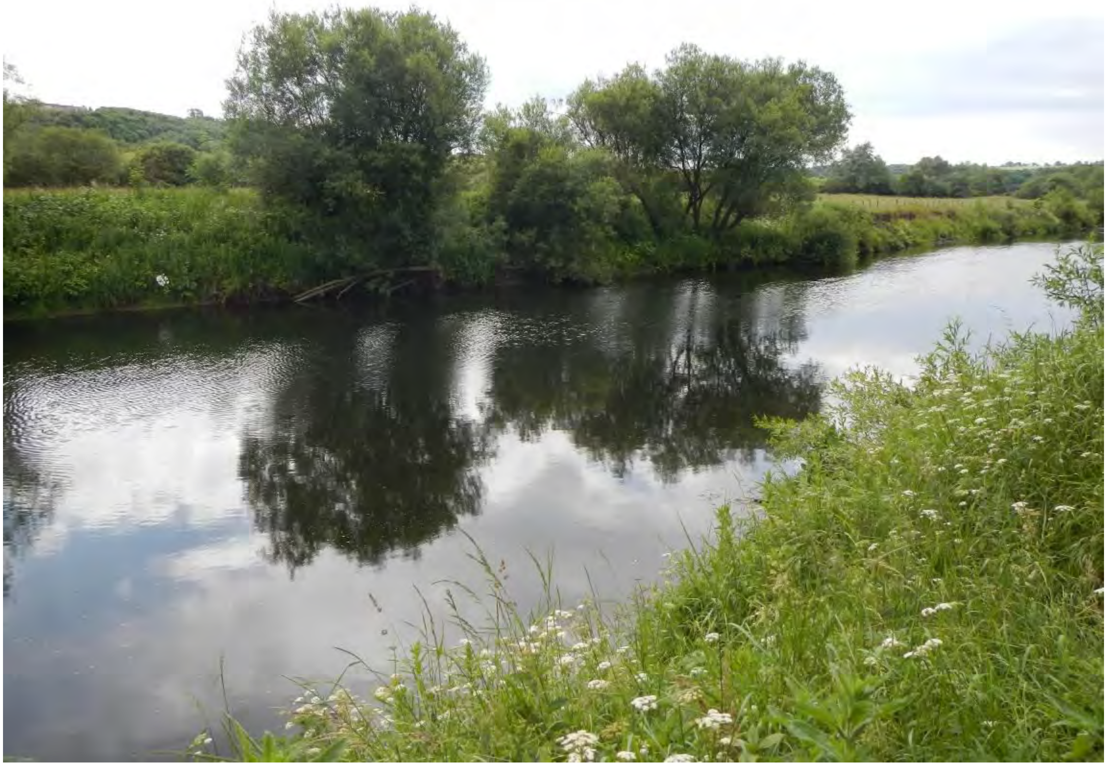


Figure 19. Over-wide channel section with little flow diversity and providing poor trout habitat. Laying willow trees into the channel would greatly improve this area.

Figure 20. Bank erosion on tributary, just d/s of culvert. The issue is greatly exacerbated by Himalayan balsam and unsympathetic rock armouring. Creating a naturally vegetated, more stable bank and therefore appropriate channel width to develop should assist with sorting of the substrate.

Willington Burn offers potential for salmonid spawning but is again significantly impacted upon. A culvert towards the confluence with the Wear (NZ 19974 34110) presents a small barrier to fish passage (Fig. 21) and the crystal clear water but fine sediment and orange/ochreous discolouration of the bed suggest a mine water influence (Fig. 22).

When poorly oxygenated, iron-laden water emerges from the ground the water becomes better oxygenated, iron oxidises and precipitates out of solution, at the same time reacting with any fine sediment particles in the water and causing them to flocculate (clump together) and fall out of suspension. The chemical process can cause issues with deoxygenation of the water, along with the problems of siltation.

A drainage channel from a spring within the adjacent field presents a further issue (Fig. 2). This spring is suspected to have occurred as the water table rebounded following cessation of pumping within old mines around the catchment. The custodian of the field has then created a ditch within the field to allow the water to escape, in the process, increasing the fine sediment input to the tributary and main River.

The presence of excess algae on the bed of the tributary may also indicate excess nutrients are entering the tributary further u/s, although, the mine water could be inhibiting the invertebrates that would ordinarily graze down that algae. It would be well worth W&DAC members undertaking further investigation of the Burn to identify any other sources of sediment, siltation or other pollution and whether there is higher quality habitat u/s, perhaps u/s of the mine-water influence.

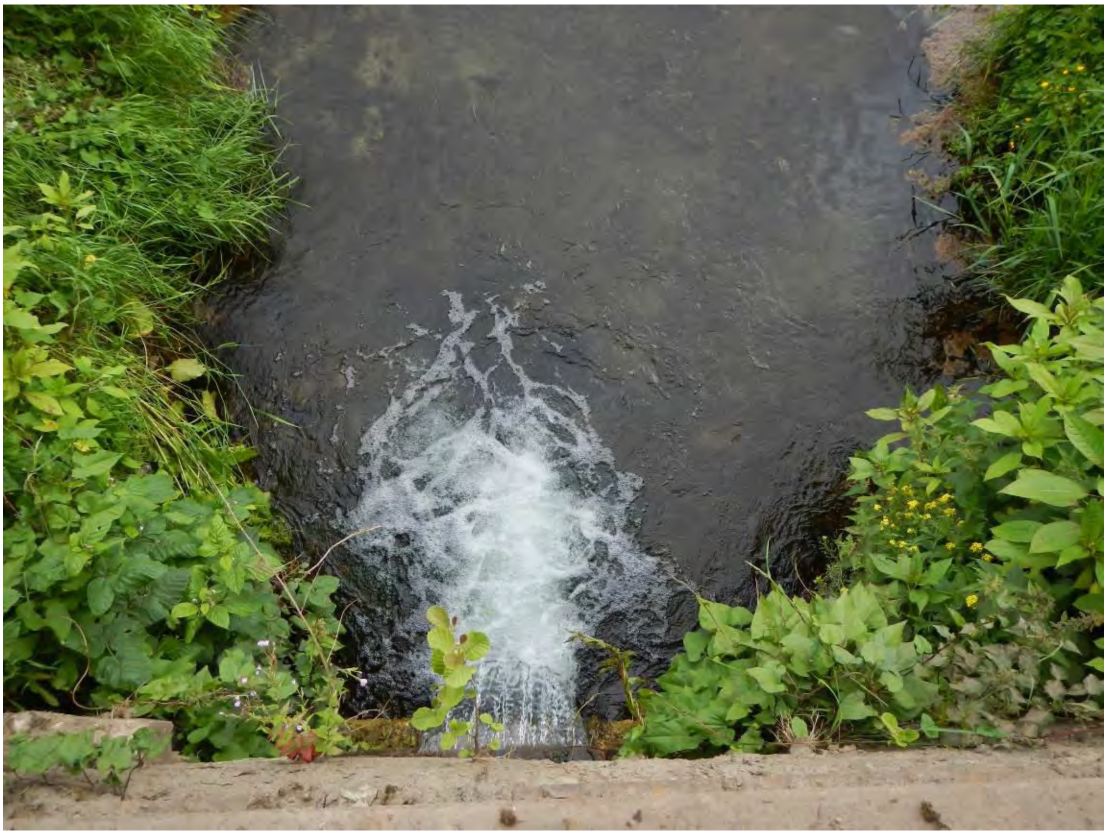


Figure 21. A small barrier to fish passage – note the crystal clear mine-impacted water.

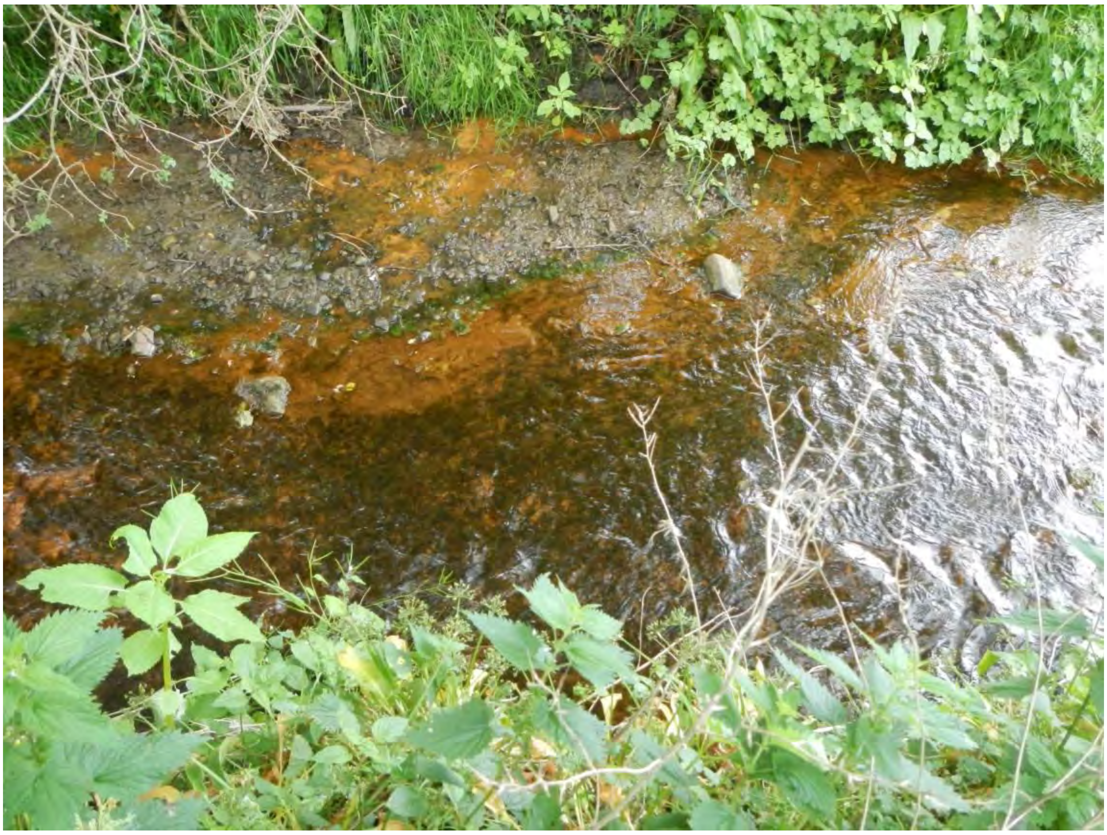


Figure 22. Ochreous precipitate and fine sediment deposition on the bed that are both likely to render it poor quality spawning habitat, despite the presence of some suitable sized substrate. Algal growth may be due to a lack of grazing invertebrates or a sign of excessive nutrient inputs upstream – both of which aspects should be investigated.

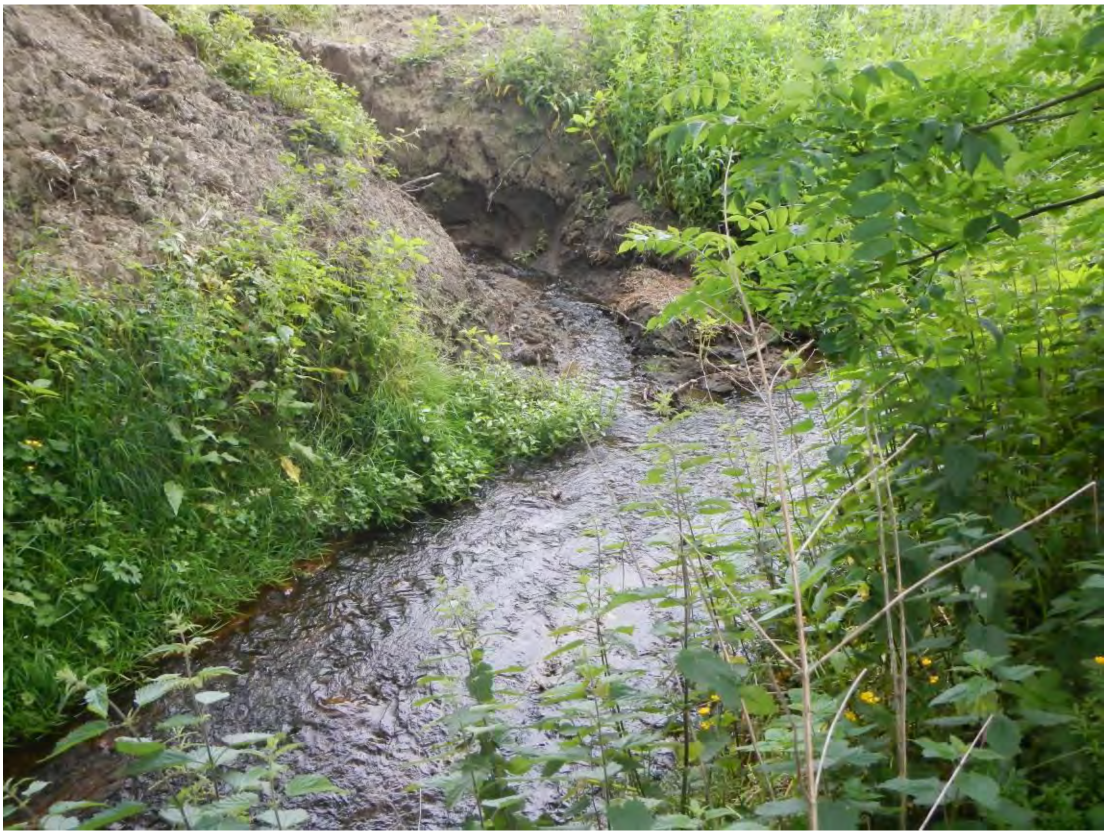


Figure 23. Outflow from the spring in the adjacent field. Excavation / dredging of this channel has created a bare earth trench that is susceptible to erosion and an additional source of fine sediment to the system.

In areas where bankside trees have been allowed to naturally encroach into the channel, the benefits are clearly visible. In addition to shade, cover and refuge, the diversification of flows (particularly high flows) has driven scour into the river bed, creating and maintaining excellent deeper water habitat (Fig. 24). This effect has occurred as the willow is on the outside of a slight bend where it has maximal flow energy working upon it in high water.

Further u/s, the opposite effect could be initiated. Being on the inside of a slight bend, the willow tree in Figure 25 could be laid into the channel to further dissipate flow energy and facilitate a greater amount of sediment deposition within the river margin. This would help naturally narrow the channel and force more of the flow along the outside of the bend where it will then create and maintain channel depth.

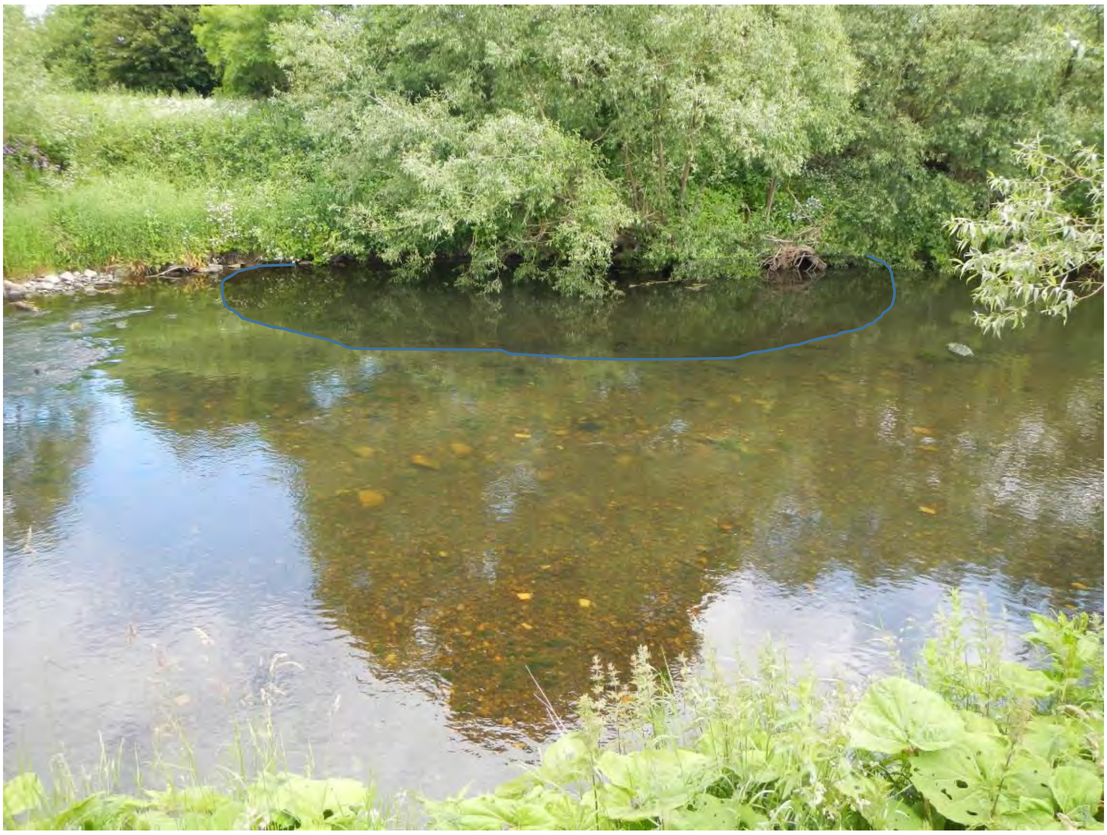


Figure 24. High quality habitat created by trailing willow branches – note how the branches have driven high flows downwards into the bed to create excellent, deeper fish-holding water.

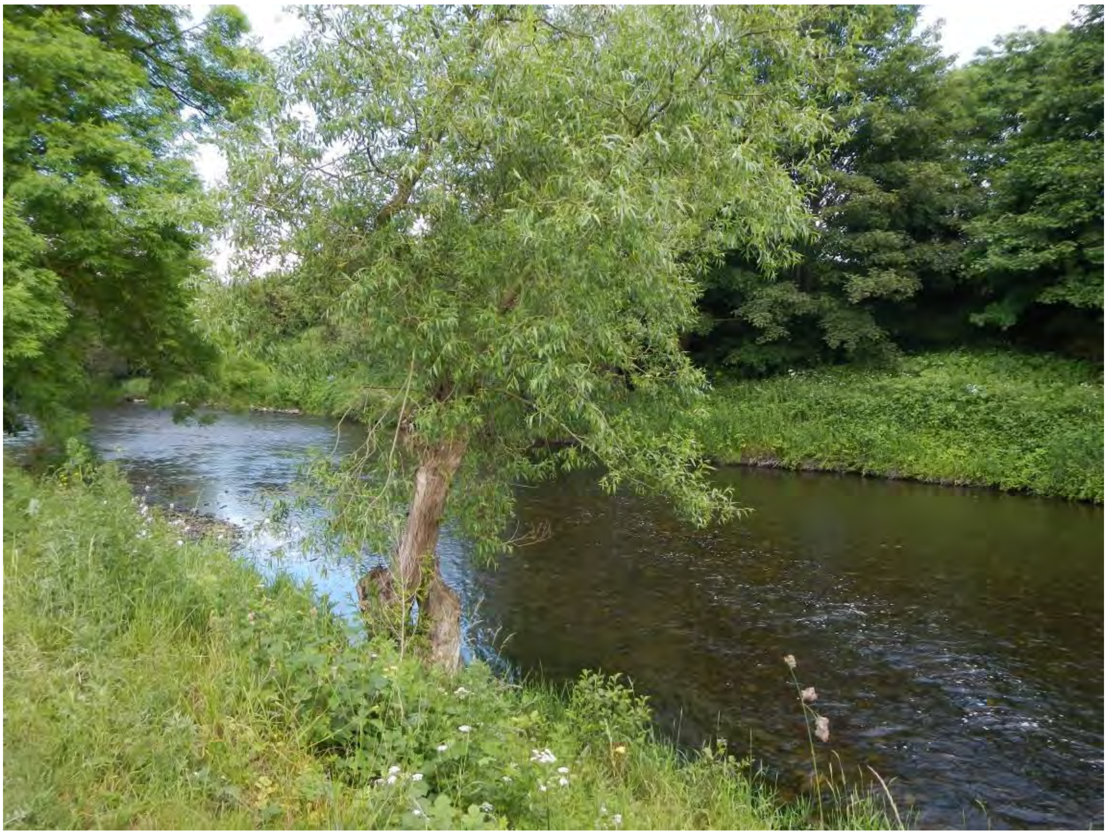


Figure 25. The willow tree (centre of shot) could be laid down into the channel to encourage greater sediment deposition in the near LB margin and maintenance of a deeper-water channel along the far bank. Planting small shrubs along the far bank would also improve the availability of cover there and the fish-holding capacity of the area.

4.0 Recommendations

The River Wear has clearly been subjected to significant channel modification and maintenance over the years, both for land drainage/management purposes (realignment and dredging) and in attempts to improve the fishery (tree pruning and weir installation). All of these aspects are likely to have had detrimental effects upon the morphology and function of the channel and the quality of habitat that it provides. However, rivers are very resilient and, given time they will begin to recover, as can clearly be seen throughout the W&DAC water.

The secret to managing a large, high energy river like the Wear is simply to try and remove the negative impacts and assist the process of natural recovery. Creating as near natural habitats as possible is the surest way to improve the wild fish populations and the quality of the angling provided. It is clear that W&DAC waters already provide conditions capable of producing viable wild salmonid populations; there are, however, a series of minor actions that can be undertaken to further improve them.

4.1 Tree Work

4.1.1 Promote low and trailing tree cover

Pruning and tidying of overhanging or fallen/collapsed bankside trees should be stopped in favour of promoting valuable low-level and trailing cover that will undoubtedly increase the fish holding capacity of the River. The best plan will be to discuss this option with all members so that everyone understands the rationale behind the decision.

In addition to providing valuable habitat, increasing the natural availability of in-channel structure will assist the natural geomorphological processes that are already underway and are improving the quality of habitat along the River. There are small-scale improvements that can be made to increase the occurrence of this habitat – all of which should be undertaken sparingly.

4.1.1.1 Planting

Where there is a lack of low-level and trailing cover along the river margins, planting is recommended. Most native deciduous species would be beneficial but willow is by far the easiest to transplant and manipulate.

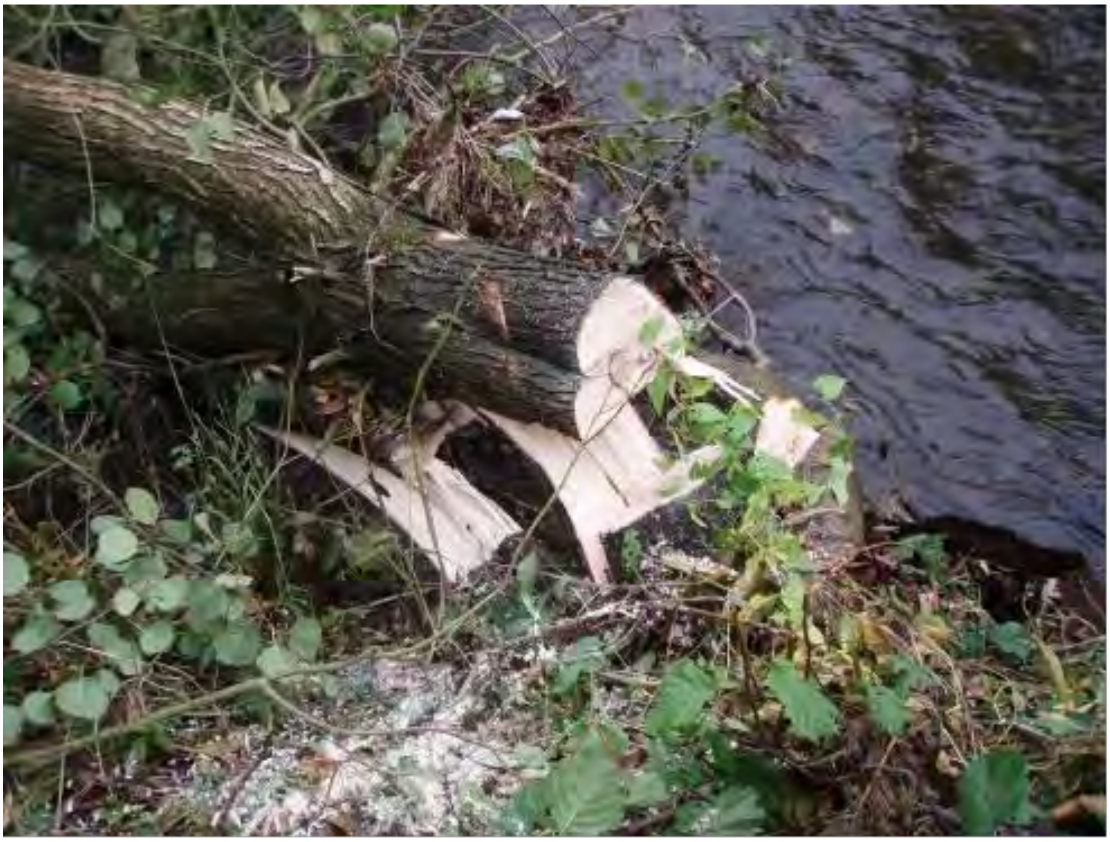
The quickest and easiest way of planting is with willow, by pushing short sections of willow whip into the ground. This can be undertaken at any time of the year, but will have the greatest success if undertaken within the dormant season, shortly before spring growth begins (ideally late Jan-March). Whips should be planted into soft, moist earth/sediment (ideally around the waterline) so that there is a greater length within the ground (c. two-thirds) than out of it, to minimise the distance that water has to be transported up the stem; 30-60cm of whip protruding from the ground is sufficient.

Planting the whips on an angle, pointing d/s and over the water will encourage beneficial low-level growth and ease the transportation of water up the stem, reducing the risk of it drying out and dying; this will also reduce their susceptibility to wash-out in high flows. Small, bushier shrub species (like goat willow *Salix caprea*) are often best but most willow can be used in this way.

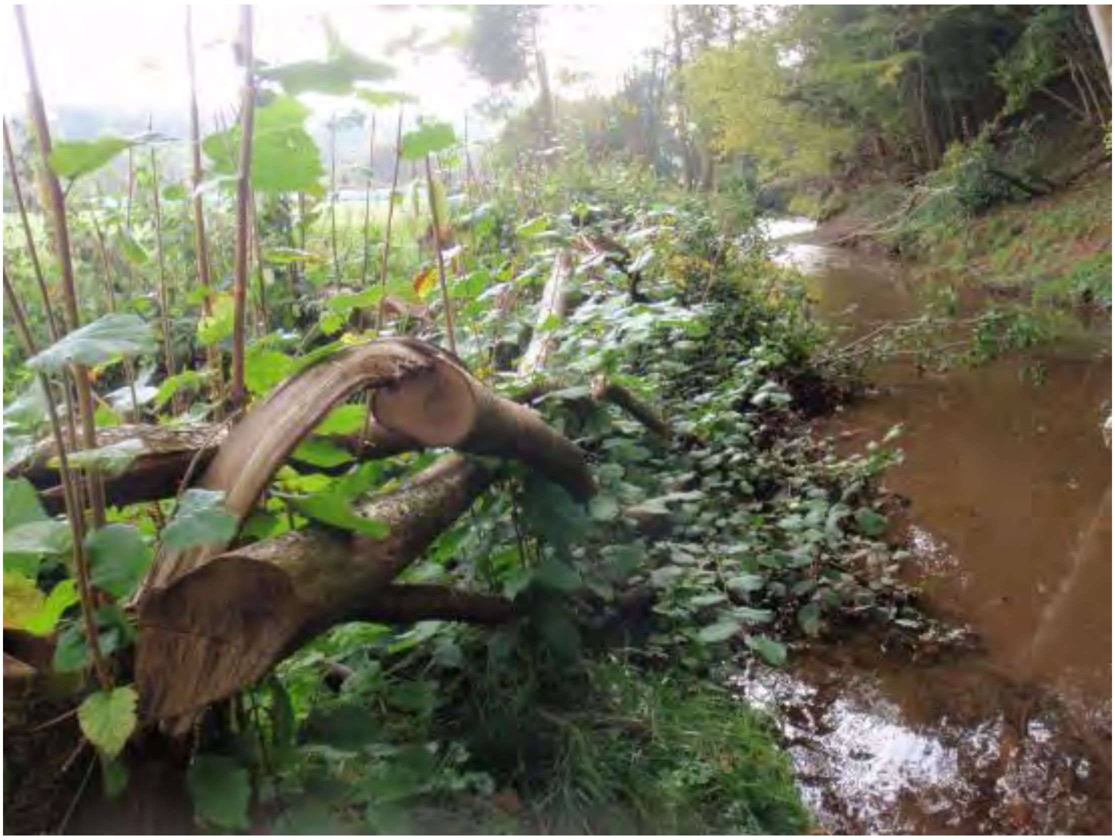
4.1.1.2 Laying/hinging

Where established trees of suitable, pliable species and size are present (willow, hazel, elm etc.), they can be laid d/s into the channel at 30^{O} or less to the bank. Laying trees replicates the natural process observed throughout the reach where tree limbs grow out over the river and sag or collapse into the watercourse, so undertaking judicious laying of bankside trees can help to reinstate some of the habitat lost through past pruning and tree maintenance.

Laying involves cutting part-way through the stem/trunk while downward pressure is applied to the stem (like laying a hawthorn hedge), until it can be forced over into the channel (Photos 26 & 27). The depth of the cut should be limited only to that which is required to bend the limb over, as this will retain maximum strength in the hinge and maintain the health of the tree/shrub. On small shrubs, cutting the stem at a very shallow angle then putting an axe blade into the cut and hitting it with a hammer can also work.



Photograph 26. Hinged willow.



Photograph 27. Hinged hazel.

4.2 Fish stock management

As already discussed, there is plenty of scope for wild fish production on the River Wear. Although the presence of spawning areas in the immediate vicinity of W&DAC waters is limited, dispersal of juvenile salmonids from other areas is already providing good numbers of juvenile fish (as observed during the visit and in angler catches). Sympathetic, hands-off management of the River, with a small amount of habitat improvement (rather than angler access improvements) should be sufficient to further improve the fish population and angling prospects.

In considering whether fish stocking is necessary on a river, it is important to first consider all aspects and whether the river could be better without stocking. Although stocking has long been seen as the only option to support a high quality fishery, the numerous wild fisheries around the UK, and indeed the rest of the world, demonstrate a better option that will cost the Club less money and can produce a greater abundance of fish.

It should be remembered that the native, wild trout populations of Britain and Ireland possess great genetic diversity, making them amazingly resilient to changing environmental conditions and able to continually adapt to a wide range of habitats and environmental conditions. This enabled them to thrive in our rivers since the last ice age (without human interference) and they should continue to do so in the future if we can limit our impact upon them and their habitats.

However, in the latter part of this period (last 50-200 years), the human impact upon wild fish populations has increased exponentially, with major issues arising from industrial pollution, the way in which we manage riparian land (e.g. significant intensification of agriculture) and how we manage rivers (e.g. dredging to increase flood conveyance, and denuding vital habitat to reduce perceived flood risk or to ease angler access to rivers). All of these factors have a significant detrimental impact on the wild fish populations that rivers can support. To compound the habitat-related issues, direct interference with wild fish populations also increased, with large numbers of ill-suited hatchery fish introduced to rivers.

Stocked fish (both diploid and triploid), are affected by domestication and unnatural selection, even within one generation in the hatchery (<u>so this includes fish from wild brood-stock schemes</u>) greatly reducing their survival rates within a wild, river environment.

Artificially pairing two fish (even wild caught fish) completely bypasses the natural mate selection process. In the wild, vital chemical and visual aspects of mate selection ensure mate compatibility and maximise the fitness of their offspring – unlike artificially paired farmed fish. Furthermore, having been grown and survived within an unnatural captive environment (concrete raceway, earth pond or tank) farmed fish are poorly adapted for the very different conditions they will experience when released to a natural river. Adaptation to a farm environment is cumulative, with the wild traits (genetic diversity and behaviours) and survival rates of farmed fish decreasing with each generation in captivity.

Stocking produces a *'catch 22'* situation: if stocked fish don't survive long enough to reproduce in the wild, or are infertile (triploids), they are just an additional impact upon the ecosystem (as the river only has a limited amount of food and space); if they do survive long enough to breed, their offspring have much poorer survival than the offspring of two wild fish. This means that by removing wild brood-stock from a river you are also removing the beneficial contribution they would have made to the population if left in the river to breed naturally.

So, what is the other option?

Well-managed, natural river habitats (without stocking) have a far greater capacity to produce and support healthy fish populations, at all life stages. From emerging out of the gravel, wild trout disperse throughout the available habitat to find territories appropriate to their individual size and dominance. They constantly compete, creating a "pecking order", which ensures the dominant fish control the best lies, where drifting food is the easiest to intercept for the least energy expenditure. They will remain there (often for years in the case of a large, dominant fish) until displaced by a more dominant individual or until they die.

This natural process ensures that the available habitat is always utilised to best effect and a river holds the optimal number of fish, with all the available habitat naturally repopulated with each year's wild fish production, from swim-up fry upwards (something that is impossible to achieve through artificial stocking because as soon as you stock fish of any size you disrupt the natural process).

As salmonid survival is density dependant, the greater the habitat variation and abundance (cover, in-channel structure and flow diversity), the greater the number of trout that will survive each year.

For this reason, increasing the occurrence of those features (low, trailing branches) and avoiding unnecessary tidying/pruning will actually increase the number of fish that a river holds.

Consider that wild fish are constantly defending their adopted territory, while stocked fish will have no affinity for the reach into which they are stocked, often being transient and selecting less energy-efficient lies. Stocked fish therefore lose condition and tend to leave the stocking location or die within a short time of being stocked, particularly if high river flows are experienced. In this time however, they cause increased competition and potentially displace the valuable wild fish, particularly smaller individuals, thereby disrupting the natural balance and potentially leading to less fish within a river section.

For example, the habitat required for five 0.5kg stocked fish may have originally supported many more wild fish, in a range of sizes from parr upwards. If those wild fish are displaced (fish that would naturally stay within that river reach), there will be less fish to grow on and naturally maintain the population.

Although it may appear counterintuitive, for all of the above reasons, stocking often leads to less fish within a river by suppressing the wild population (particularly if stocking is undertaken year upon year) whereas wild fisheries have the potential to support much greater overall fish populations. Consequently, many angling clubs actually report increased catches after ceasing stocking as demonstrated by the ever-increasing number of case studies that on the WTT website link - www.wildtrout.org/content/trout-stocking.

An excellent video produced by Wild Fish Conservancy North West documents how Montana stopped stocking and greatly increased fish numbers in rivers – www.youtube.com/watch?v=U_rjouN65-Q&app=desktop

To safeguard natural fish populations, increasing the rate of catch and release fishing is advisable for both resident and migratory fish. This need not be mandatory but will greatly assist in preserving valuable wild spawning stock and improving natural trout production.

Any large wild fish caught clearly possess the characteristics necessary to survive well within a river and if these fish are returned, they have a good chance of attaining even larger size and further enhancing angling opportunities. On fisheries where a very high percentage or complete catch and release is practiced the results are often staggering, with fish produced way in excess of the sizes expected; however, this cannot be achieved if the fish are killed before they have had time to attain their maximum potential size. Even reasonably light exploitation can limit the upper size that resident trout achieve; conversely, on many fisheries where near or complete catch and release is practiced, good numbers of fish are now reaching trophy sizes.

Considering the above factors, the presence of a range of wild fish already present (as observed during the visit) and the suitability of habitat within the River to produce and support those fish, it is recommended that stocking of the River is ceased in favour of promoting a wild fishery – as many clubs and associations across the country and River Wear catchment already have. Money currently spent on stocking could be beneficially redirected towards habitat improvements that will further increase the wild fish populations of the River (see case WTT site for case studies of other clubs that have already stopped stocking www.wildtrout.org/content/trout-stocking).

Completely stopping stocking would be the best result for the wild trout population and produce the best results; however, some clubs choose to reduce the stocking to zero over a couple of seasons, whilst monitoring catches, to placate any members dubious of the benefits of a wild fishery. It should be understood that wild fish do take time to grow on, so a short period of adjustment could be expected after stopping stocking, although many clubs experience the benefit within a season.

4.3 Pollution prevention / water quality

To ensure that the conditions are optimised for wild trout production, it is recommended that all outfalls and tributaries to the River are monitored, with any abnormalities or suspected pollution events immediately reported to the Environment Agency's Pollution Prevention Hotline (0800 80 70 60). Unfortunately, this may not always generate a site visit response but it is important to log all incidents that occur to ensure that they are taken seriously and to force improvements to the infrastructure or operating regime.

Undertaking river fly monitoring (www.riverflies.org/rp-riverfly-monitoring-initiative) at sites on the tributaries and u/s and a short distance d/s of any suspected issues would also help identify any issues, along with in long-term trends in the water quality of those reaches.

Further investigation of the Willington Burn should be undertaken to identify whether habitat quality improves u/s, the potential sources of sediment and nutrients and whether they can be addressed.

4.4 Spawning tributary enhancement

There is definite potential to improve the habitat quality of Page Bank Beck (NZ 23039 35412) for salmonid spawning, despite the obvious long-term degradation through straightening and dredging. For this reason, it is strongly recommended that the landowner/tenant is approached to see if maintenance of the channel can be stopped to allow recolonisation with vegetation and flow deflectors/in-channel structures be installed to kick-start recovery of the channel. The channel is it is already significantly lower (c.1.5 - 2 metres) than the level of the adjacent fields, meaning that even quite large alterations within that channel will not negatively impact upon land drainage.

Simple paired or alternating deflectors could be used to pinch the channel and drive bed scour, sorting the substrate and greatly improve the habitat quality of the channel (Fig. 28 & 29). The Beck is severely degraded but does already contain some salmonid fry (as observed during the visit), the numbers of which can be increased with more sympathetic management/habitat improvement.

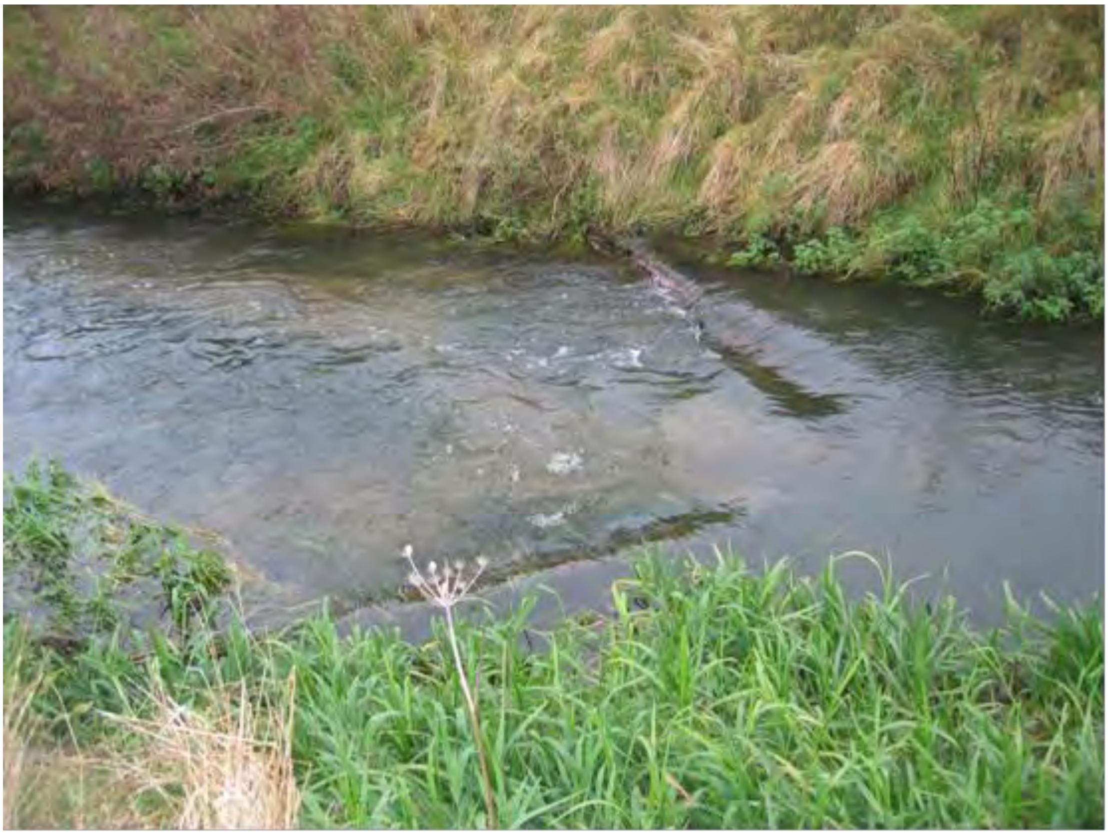


Figure 28. An example of paired, upstream facing flow deflectors that could be employed to improve the channel of Page Bank Beck by focussing flows through a narrower central cannel that will create depth and scour and sort the bed.

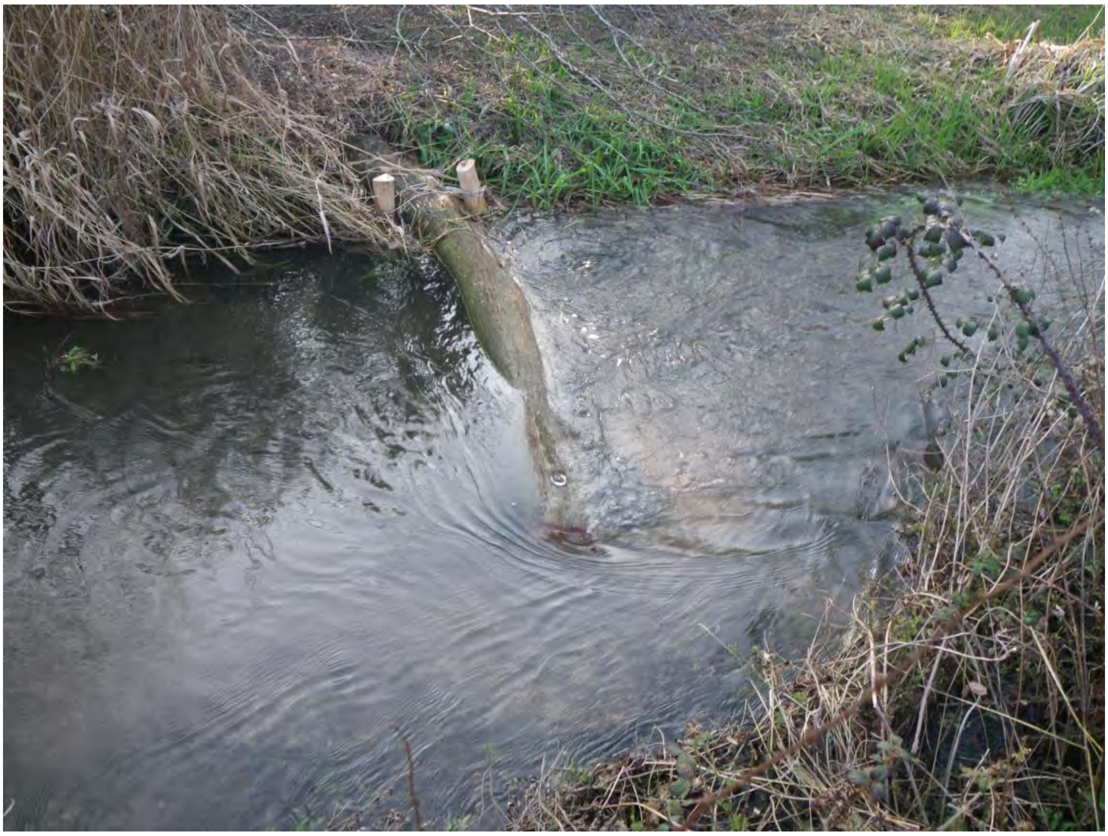


Figure 29. A single flow deflector, as is often used to increase flow diversity, sinuosity (move the flow from one bank to the other) and bed scour within a simplified channel. One would be installed to butt against on one bank and the next installed against the opposite bank further along the channel.

Increasing the in-channel structure of Willington Burn may also be beneficial to improve the physical habitat but, before a lot of time and effort is expended, it will first be beneficial to identify the potential pollution issues and whether the water quality of the Burn is currently capable of supporting fish and invertebrates.

4.5 Non-native Invasive species

Non-native invasive species should not be tolerated and the Japanese knotweed stand at NZ 22885 34990 should be treated with herbicide by qualified personnel as soon as possible. The issue with Himalayan balsam should also be tackled but will require a catchment based approach – something Wear Rivers Trust may be able to assist with.

5.0 Making it Happen

WTT may be able to offer further assistance such as:

- WTT Project Proposal
    - Further to this report, the WTT can devise a more detailed project proposal report. This would usually detail the next steps to take and highlighting specific areas for work and the exact actions that can be taken, 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 improvements highlighted in an advisory visit report, there is the possibility of WTT staff conducting a practical visit. This would consist of 1-3 day's 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. <u>This service is in high demand and so may not always be possible.</u>

- WTT Fundraising advice
    - Help and advice on how to raise funds for habitat improvement work can be found on the WTT website – www.wildtrout.org/content/project-funding

The WTT officer responsible for fundraising advice is Denise Ashton:

dashton@wildtrout.org

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

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 populations and managing invasive species.

The DVD is available to buy for £10.00 from our website shop

www.wildtrout.org/product/rivers-working-wild-trout-dvd-0

or by calling the WTT office on 02392 570985.

6.0 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.

7.0 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.