River Irwell – Little Britain Anglers

An advisory visit carried out by the Wild Trout Trust – July 23rd 2015

1. Introduction

This report is the output of a Wild Trout Trust (WTT) Advisory Visit (AV) undertaken along ***approximately 1km (0.62 miles) of the River Irwell in Bury.***

The visit was carried out by Dr. Paul Gaskell and hosted by Eric Owen and Paul Heywood of Little Britain Anglers. The River was walked from a downstream limit at NGR (National Grid Reference) SD 80211 08440 to an upstream limit at SD 79982 08985.

Throughout the report, normal convention is followed with respect to bank identification i.e. banks are designated **Left Hand Bank** (**LHB**) or **Right Hand Bank** (**RHB**) whilst looking downstream.

2. Catchment overview

The source of the river is at Irwell Springs on Deerplay Moor, approximately 2.4 km (1.5 miles) north of Bacup. It forms the boundary between Manchester and Salford and empties into the River Mersey near Irlam. The Irwell's position at the heart of the industrial revolution meant that it has suffered terrible pollution problems during its history. Water quality is now much improved but further possible improvements are desirable and investments need to continue to be made in water treatment facilities.

Bedrock geology consists of sandstone and coal measures as part of the Middle Pennine Coal Measures. Surficial deposits are predominantly alluvial gravels, silt and sand. As such, beneath the disguise of industrial and urban developments, the Irwell is a classic rain-fed, upland river.

The surveyed sections of watercourse are all captured within a single waterbody (GB112069064620); listed by the Environment Agency as River Irwell, Rossendale STW to River Roch. Its most recent Water Framework Directive (WFD) classification (2014) is as "Moderate" ecological potential. The main reasons for this designation are the hydromorphological supporting elements. In plain English, this means that weirs and engineered alterations to the dimensions and course of the river have reduced habitat quality. It is disappointing to note that the previously "Good" status of phosphate levels in the water (2009 assessment) had been downgraded by two full categories to "Poor" by 2014.

The findings of the Habitat assessment (Section 3 of this report) highlight examples of how standard classification schemes often fail to capture significant issues. On the one hand, the WFD classification rightly identifies problems caused by weirs that impound flow and prevent natural processes of erosion and deposition that produce good habitat. There are also the more obvious effects of weirs as barriers to free upstream and downstream movement of aquatic life.

However, the impacts of multiple, severe infestations of invasive, non-native plant species are not taken into account. As a result, the system that is designed to achieve good ecological status for UK waterbodies will not identify or address some fundamental and severe ecological issues for river corridors.

The river was surveyed in a downstream to upstream direction and the observations are reported in the order that they were recorded. The next section provides the key findings from the visit and these are based on visual inspection and conversation with Eric Owen and Paul Heywood.

3. Habitat assessment

The downstream limit of Little Britain Anglers' water is characterized by densely-wooded LHB and vertically-walled RHB. The club have worked hard to establish a path through brambles and giant hogweed at the top of the LHB – which is flanked by security fencing that separates the river corridor from adjacent development. The understory vegetation in this wooded section – as well as much of the open space along the walled sections – is dominated by dense stands of a variety of invasive plant species. For instance, Japanese knotweed (*Fallopia japonica*), Himalayan balsam (*Impatiens glandulifera*) and giant hogweed (*Heracleum mantegazzianum*) choke both the shaded understory and any available gaps under the tree canopy (Fig. 1). All of the invasive, non-native plants observed during the visit belong to species that die-back in winter – leaving bare ground that is poor in native flora and fauna (as well as highly prone to accelerated erosion and associated increased inputs of fine sediment).

Figure 1: The bottom of the river-valley slope at SD80211 08440 showing a path cut through Himalayan balsam next to a stand of Japanese knotweed under the shade of mature trees. Knotweed and giant hogweed are present on the opposite bank and part of a high, structural wall constructed from barrels filled with concrete is just visible through the branches centre and right of frame.

The club has members who are qualified to use herbicides adjacent to watercourses and they are aware that different, specific methods of control are required for each of the different invasive plant species. It is especially reassuring to note that the club knows not to strim or flail knotweed – as this causes it to spread the infestation (a fragment of around the size of the last joint of your thumb is capable of growing into a whole new plant).

The water in this section is relatively deep and slow-flowing. This is likely to be due to modifications to the size and shape of the river channel. Currently, there is a general lack of structural and physical (i.e. flow) variety within the channel. This will reduce its value to a range of fish and other aquatic wildlife.

The club are conscious of (and keen on) the value of providing structural variety and cover from predation. They have identified an overhanging tree that they recognise will probably attract the attention of flood risk managers (Fig. 2). It is great to hear that they would like any action taken in the name of flood risk reduction to maximise habitat benefits. This would be a prime candidate for producing a "tree kicker" parallel to the riverbank (See Section 4: Recommendations). As well as the low cover, cooling shade and sheltering effect during fierce spate flows – willow is also excellent for protecting against the accelerated erosion caused by banks denuded of winter vegetation by invasive flora. When secured parallel to the bank – it will encourage deposition of fine sediment and may also be able to strike roots to further bind together the loose earth where shallow-rooted invasive species currently dominate.

Figure 2: Willow leaning over and rooted in relatively soft bank at SD80158 08438 which is a good candidate for a tree kicker

Treatment of Himalayan balsam and giant hogweed is underway on this section (Figs. 3 and 4) – but the club is at the very start of their campaign against invasive plants on this part of the river.

Figure 3: Broken stems of balsam and examples of targeted spraying of giant hogweed at SD8058 08438. The club has developed a phased approach to giant hogweed control. The first stage is to break the stem close to ground level using a long-handled garden hoe (wearing full protective clothing to prevent contact with sap). As the plant tries to recover, herbicide is used to kill off the regrowth

Figure 4: Giant hogweed at SD80158 08438 undergoing treatment from the club

Just upstream, there was a very good example of how the giant hogweed is dominating, both in small clearances among the trees (Fig. 5) and as an understory to established trees (Fig. 6). It is evident that the age/size structure of the trees in this reach is very "flat". In other words, it appears that the most recent tree removal activity is likely to have been carried out on a blanket basis.

Removing all (or at least the great majority) of the trees at one time creates a very uniform canopy and shade structure. This tends to hinder the development of varied habitat that is rich in species.

The major problem here is that the domination of the understory by invasive, competitively superior, plants will prevent tree seedlings from becoming established. This will also hinder the prospects for healthy and vigorous regrowth following any future coppicing of mature trees.

It will be necessary to gain control over the invasive plant understory before making any attempts to improve the light/shade regime by managing the tree canopy structure (Section 4: Recommendations). It is also very important to recognise that providing areas of shade on the water will be vital for cold-water specialist species such as trout. This is especially important in the context of climate change. A useful guide to shade provision as a means of providing cool-water refuge areas is available here: http://www.asfb.org.uk/wp-content/uploads/2012/09/Keeping-Rivers-Cool_Guidance-Manual_v1.-23.08.12.pdf.

As detailed in section 4 (Recommendations) there are significant advantages to using stem injection in preference to sprayed application of herbicides for plants that cannot be controlled by physical methods (i.e. hand-pulling or strimming). The improved targeting that stem injection allows not only protects native plants that can take the place of the invasive plants – it also delivers the herbicide much more effectively into the plant that you wish to remove.

Figure 5 Giant hogweed growing in a clearing between trees

Figure 6: Ignoring the immediate foreground, almost all of the shaded area beneath these willows is dominated by invasive, non-native plants. Whatever understory foliage is not Himalayan balsam (light green) is giant hogweed (darker green) in this stand.

Giant hogweed has particularly nasty implications for human injury (the sap is activated by the UV component of sunlight and produces serious skin burns as well as other, long-term health problems). The skin damage cased is a chemical burn, not an allergic reaction. This fact is not known or understood by a large proportion of the general public. In ecological terms, the combined effect of all the species of invasive, non-native plants on this site is severe. It is important not to let the issue of giant hogweed take attention away from the other invasive species.

Figure 7 shows a very strong argument for tackling all of the problematic plant infestations. On the left hand side of the frame, there is a large stand of what appears to be a hybrid between Japanese knotweed and giant knotweed (the hybrid has the Latin name *Fallopia x bohemica*). On the right hand side of the frame is an equally large stand of Japanese knotweed. Both infestations are completely dominating this section of the opposite bank and will die back in winter to leave bare earth.

Figure 7: The large-leafy foliage to the left of the opposite bank is hybridised giant x Japanese knotweed. The right hand side is standard Japanese knotweed with a few individual giant hogweed plants. The density of shade produced in summer will be lethal to low-growing native understory species and tree seedlings. Photograph taken at SD 80014 08607 where the water depth is much reduced compared to the reaches just downstream of this point.

One of the significant consequences of the plant infestations in this reach is that the potentially valuable shallow "nursery" habitat for fish (Fig. 7) will not have sufficient cover. A lack of larger trees that grow out over the channel and provide large structural debris (as well as trailing/submerged branches and roots) causes an absence of refuge from predators. In turn, this produces a high risk that only a small proportion of fish that hatch from eggs will survive their first year. The problem will be amplified during the cold parts of the year when all of the invasive plant species at this site die back. For species such as trout that breed during the colder months, this lack of cover comes at a crucial point in their lifecycle. It is also a "make or break" stage for juvenile trout approaching one year of age – as overwinter mortality is naturally very high (typically 95% of trout and salmon die before one full year of age - even in good habitat). Additional mortality due to a lack of suitable over-wintering shelter from both predation and also high winter flows can have serious impacts on the viability of self-sustaining populations.

Some better juvenile cover was present in the form of cobble/rubble substrate in the shallow glide at SD 80035 08647 (Fig. 8). The gaps between and underneath the surfaces of larger cobbles and rocks provide enough shelter for small fish to escape predation. There would be great benefit to providing additional and alternative forms of submerged cover (for instance trailing branches or equivalent structures) in this area.

Figure 8: Good juvenile habitat (in-stream) and potential sources of additional cover from young trees (Section 4: Recommendations)

At the top of this shallow glide/riffle area there was a good ramp of gravel that is suitable for trout spawning (Fig. 9). For spawning gravel – the conditions that enable water to be drawn through (and not just above) the bed are vital for good egg survival. Without this "through-gravel" flow – the eggs become starved of oxygen. Sometimes this is achieved when flows are focused in a small area by being forced to flow under or over an obstruction (e.g. Fig. 10). This can be especially valuable when there are large inputs of fine silt and sand. However, it is important to recognise that frequent large inputs of fine material can swamp this localised cleaning effect (see video here for an example of how winter die-back of invasive plant species can lead to this effect: https://youtu.be/VijmRm-qd4Y).

Whilst logs can produce essential but relatively localised patches of "through-gravel" water flow, natural processes that shape river channels can also promote this effect at a larger scale. For example, the upward slope of a larger gravel deposit at the tail end of a pool or glide produces good "through-gravel" flow potential. Gravity helps to draw the flow down through the raised bed to exit on the downstream side of the deposit (Fig. 11). This is the situation at SD 80057 08692 (Fig. 9 as mentioned above).

These features can only develop when water flows with enough speed to redistribute gravels during higher flows. Where weirs impound flows and promote a blanket deposition of much finer sediment that spans much of the channel – it substantially reduces the potential for good spawning areas to develop.

Figure 9: An upward-sloping ramp of gravel is present to the right of the frame. The broken water visible towards the middle and left of the frame is on the downstream side of the gravel ramp- below the high-point.

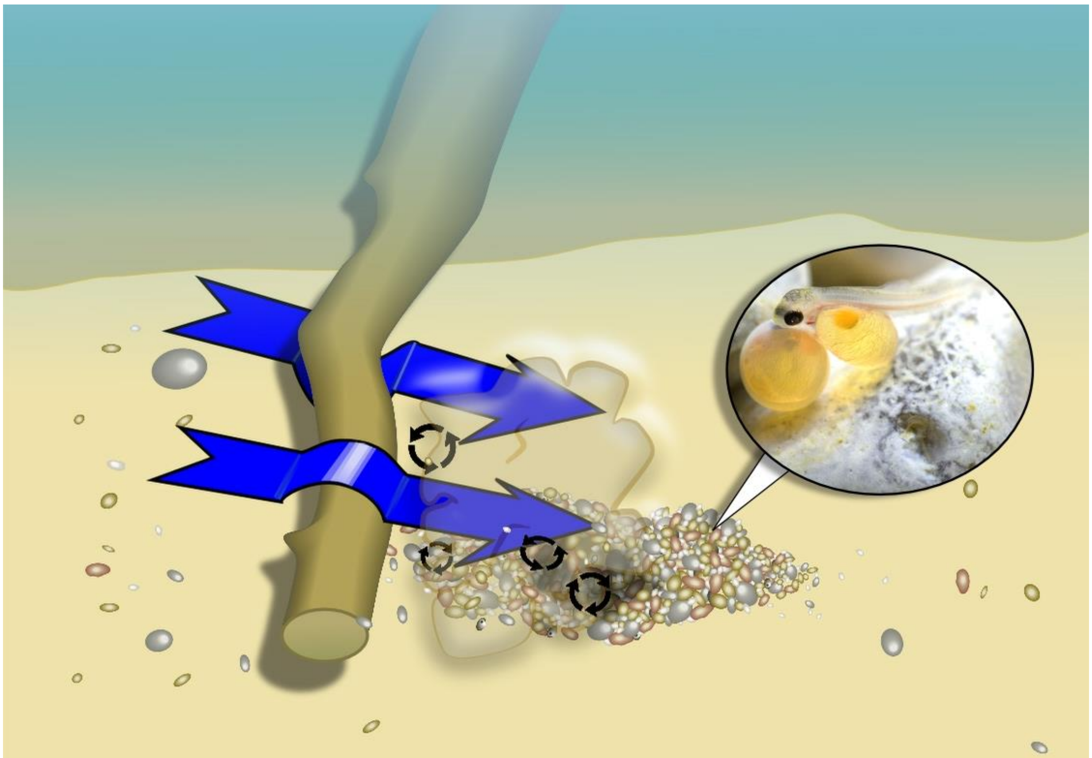

Figure 10: Localised scouring flows focused downwards into a silt and gravel deposit. The heavier gravels re-deposit downstream of the scoured hole whilst the finer sediment is carried further downstream until it is carried into an area of current that is slow enough to let it settle. The silt-free gaps between gravel grains are perfect for developing eggs and hatched trout larvae with their yolk sac (inset).

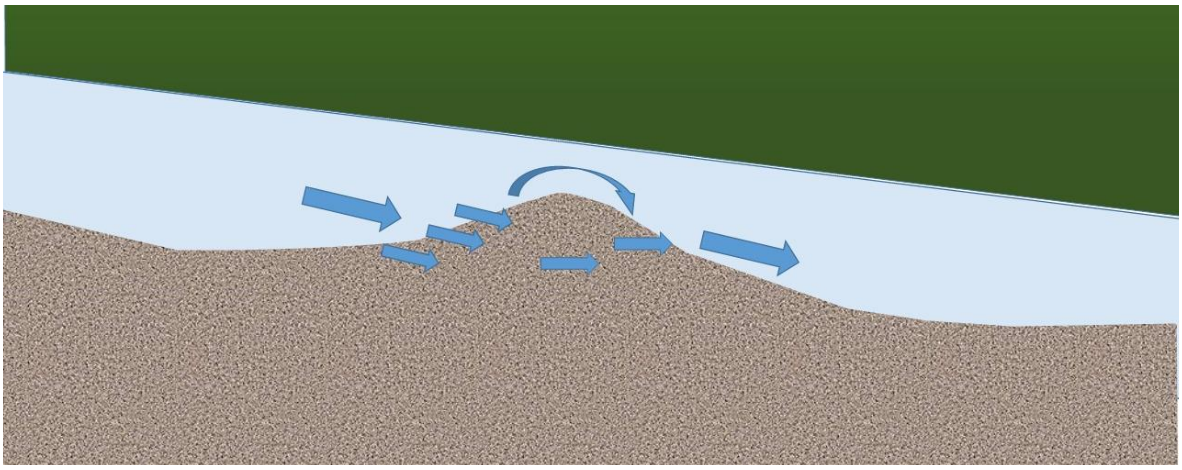

Figure 11: Exaggerated riverbed profile (side-elevation view) demonstrating "through-gravel" flow produced when gravel deposits form a sloping "ramp" on their upstream and downstream faces. The blue arrows indicate water-column and through-gravel flow. These conditions ensure a continual replenishment of oxygen-rich water that is transported through the gaps between gravel grains.

At SD 80073 08739 there was an example of potential problems with partial treatment of bank-side Japanese knotweed infestations. Although not carried out by the angling club, Fig. 12 is a useful illustration of unintended consequences. The accessible bank-side portions of the stand were successfully suppressed by spraying. However, the soft bank – coupled with the relatively heavy (sap-filled) living canes- has resulted in the river-side portion of the infestation toppling forwards. This resulted following the death and partial collapse of the cane and root system of the treated area which weakened the attachment to the bank of the surviving plant material.

Figure 12: The living (river-side) portion of this Japanese knotweed clump is pulling a "plug" of riverbank and dead canes/roots (bank-side) into the water. This will distribute stems and root-systems (rhizomes) that will establish new colonies downstream

Proposals have been made by the club to obtain and use gabion baskets to repair bank collapses caused by invasive plant infestations; they will require careful implementation to avoid some common mistakes. First of all, the upstream and downstream ends of bank revetments built using standard “block-shaped” gabion baskets always produce swirling eddies. This is due to the perpendicular arrangement of the faces of each “block”. These swirling eddies generated by the hard, angular surfaces of the gabion baskets eat into the soft bank. This greatly accelerates the rate of bank erosion at the upstream and downstream ends of each revetment (e.g. Fig. 13 on a small section of the River Colne in East Lancashire). The same effect is seen when using block stonework.

Figure 13: The flow in the picture is coming from the bottom left and travelling to the top right of frame. In spate conditions the eddy formed on the downstream face of the gabion revetment has eaten into the bank-line for a distance that is about double the width of the revetment.

Smoothly-tapering ends of any bank reinforcement are needed to make them stable – rather than increasing the rate of bank erosion. It should be noted that bank erosion in itself is not a bad thing – it is the source of spawning gravel substrate and can contribute additional structural variety to the channel. In channels that are modified and impacted by issues such as over-grazing or invasive species, there are often tricky judgements to be made in order to achieve the best balance of erosion and deposition. You can have too much stability and you can have too much erosion – the optimum for biodiversity lies somewhere in the middle. There is more, very relevant, information and a short video on this link: http://www.wildtrout.org/blog/bank-erosion-matter-balance.

For the examples of collapsing sections of access path constructed at the foot of the river valley by the angling club - it is appropriate to slow the rate of erosion in targeted areas. Slowing erosion is especially appropriate when it inhibits the downstream spread of Japanese knotweed rhizomes. In the medium to longer-term, slowed bank erosion will be best achieved by promoting and managing healthy marginal tree growth (Section 4: Recommendations). In the shorter term, where water-depth allows work in the channel, construction of berms (perhaps reinforced with wire mesh) that are of a streamlined "pasty" shape may be useful. These should be keyed into the bank-line at a shallow angle to limit their potential to create erosive eddies (Section 4: Recommendations).

Some excellent examples of good vegetation management by the club were noted on the RHB and photographed facing upstream from SD80073 08739 on the LHB (Fig. 14). Promoting the growth of young willow saplings in "withy beds" and then hinging them so that they lay in the margins (using the same technique as for hedge-laying) is a fantastic way to provide cover from predation as well as slowing rates of bank erosion. This also creates areas of slack water during spate flows – again providing refuge for invertebrates and young fish that would otherwise be swept downstream. Illustrations and proof of these concepts is given in this video made on the Wye and Usk system: https://vimeo.com/56645859.

Figure 14: Young willow saplings laid into the margin on the opposite bank - great habitat for juvenile and adult fish. With targeted control of invasive plant species – these techniques will be ideal ways of managing erosion whilst providing suitable fishing access (by opening up small gaps in dense stands of trees) and improved habitat for fish and invertebrates.

Another ramp of gravel with good potential for trout spawning was noted between the hinged willows and the glide upstream starting at SD80072 08778 (Fig. 15). However, its value would be further increased in the presence of additional cover. The potential spawning area is a long way from the nearest available overhanging or submerged structural cover. This can significantly increase the risk of predation to breeding fish – and consequently may make fish unwilling to use the available resources to their full potential. Trout breed during the winter months when the banks would be bare following the die-back of knotweed, balsam and hogweed. Establishing some submerged, marginal cover adjacent to the spawning gravels would be very beneficial. Such cover is also a haven that fry emerging from the gravels in spring can move directly into.

Figure 15: The only overhanging and trailing cover next to the spawning gravels (on the upstream side of the broken water) is provided by giant hogweed and Japanese knotweed. These will be absent during trout spawning.

In-channel modifications appear to have been undertaken in an effort to provide a deeper channel in the area upstream from SD 80072 08778. The riverbed cobbles have been pulled back from the central channel and used to produce rocky, sloping margins with some formal angling pegs set along this length of channel (Fig. 16).

Figure 16: Riverbed cobbles pulled back to produce sloping banks and a deeper central channel.

This is generally poor habitat for a range of fish species – due to the lack of physical variety. Even for coarse fish species that prefer slower, pool-habitat – there are insufficient holding features and protection from predation for this section to reach its potential. It is also likely that, given significant spate flows, the channel will begin to re-assert the dimensions that are automatically set by the gradient, hydraulic "roughness" and discharge parameters.

For a short-term gain, it may be beneficial to introduce large boulders into this reach to provide some physical variety and also to produce a more varied pattern of riverbed deposition and erosion. The transport through this reach of river-bed material from upstream (during spate conditions) could be harnessed to produce a more "humps and hollows" topography. Scattered boulders would encourage deposition in the lee of boulders with a limited amount of local bed-scour around the lateral edges.

Ultimately, the control over invasive plant species and the establishment of varied riverside tree canopy (with the associated incorporation of hinged "brashy" cover and secure anchoring of larger structural woody debris) would be required to bring out the best in this section. All of these things can be achieved whilst maintaining and enhancing opportunities for angling using both coarse and fly-fishing tactics.

The tree-planting along this section is a good initiative (Fig. 17). However, for maximum benefit, planting of tree species that thrive in wet ground conditions such as alder (*Alnus glutinosa*) or goat willow (*Salix caprea*) should be carried out in (and directly adjacent to) the margins of the river.

Figure 17: Grazing guards protecting young trees (left of frame). A good initiative - but it needs care to select sites with sufficient light (and sufficient space between individual trees as they mature). In addition, greater value to the river habitat would be obtained from planting into the wetted margins.

As marginal trees grow, a program of selecting young saplings to hinge (from tree species that will tolerate this management) as well as individual large trees for marginal “tree kickers” will be required. In this way, angling access can be maintained while simultaneously increasing the fish-holding capacity of this section of river.

The clubs willingness to provide cover for fish is noted in examples such as the hinged small willow at SD 80063 08847 (Fig. 18). For maximum benefit, this tree could be hinged at a point lower down its main stem. Angling it down more steeply into the water would allow a greater proportion of the brashy crown of the willow to be submerged at normal flow-levels.

Figure 18: Great overhanging cover - a small tweak to allow more (but not all) of the crown to be submerged would provide even more benefits.

Throughout the sections downstream of SD80063 08847, invasive plant control has only been initiated over a few weeks prior to the visit. By contrast, the section upstream of this location - as far as the entrance point behind Eric Owen’s house – has benefited from Eric’s efforts to control hogweed on the LHB over the last 12 years. During this time, intermittent control has also taken place on the opposite bank (RHB) and the contrast between the three conditions of “uncontrolled” (downstream sections), “continuous control” (Eric’s LHB) and “intermittent control” (RHB opposite Eric’s) is striking.

The varied, largely-native rough margins and valley sides on Eric’s LHB (Fig. 19) contrast markedly with the amount of giant hogweed re-invasion among what is still relatively diverse native flora on the RHB (Fig. 20). The suspension of previous control efforts on the RHB bank will soon lead to a reversion to a much-degraded state. The example given in Fig. 21 shows a good approximation of what the ultimate floral composition will be if left unchecked.

Figure 19: Eric's bank (LHB) with a shaggy margin of native plants and maintained access path. Just the occasional, small hogweed plant is present in this section thanks to a huge amount of predominantly one-person's work

Figure 20: Native flora on the RHB opposite Eric's that has now had its invasive plant control withdrawn. The bank is in the process of being re-invaded by hogweed and balsam from the river margin back up the slope

Figure 21: Giant hogweed and Himalayan balsam on the near bank with knotweed(s), Himalayan balsam and giant hogweed on the opposite bank. The likely "climax community" state of vegetation along the Irwell.

Efforts to increase channel capacity and remove mid-channel island features for flood risk reduction have rightly been opposed and modified by the angling club. The removal of such material essentially creates a void that river processes fight hard to refill. This generates a huge demand for material upstream and the resultant erosion that occurs to meet this demand can have unpredictable consequences. Information on the unintended effects of dredging mobile riverbed substrate in order to increase channel capacity (especially on rivers with the gradient of the Irwell) is given in this short video: https://youtu.be/OAZ_BuyM41s.

The measure suggested by the angling club of installing a wedge-shaped mid-stream flow deflector (Fig. 22) may well be a good way of maintaining wetted channels either side of the main mid-channel island. It is futile, and potentially damaging, to attempt to increase capacity for flows by removing this material. Instead, promoting the continued existence of complex, braided channel flow is an incredibly valuable habitat type that is comparatively rare on a national-scale.

As well as additional potential spawning habitat, the shallow slopes and complex water-column and through-gravel flows provide many additional opportunities for a very wide variety of terrestrial and aquatic species. The fact that the sloping bars will experience a varied inundation and drying regime also creates unique habitat opportunities. There is a characteristic group of species of plant and animal that are adapted to these highly changeable habitats. Because such habitat is rare at a European scale, the characteristic communities that need this type of habitat are also rare. In future, management of invasive plant species and also the age-structure of self-setting trees is likely to be needed in order to maximise the potential biodiversity. Further attempts to remove the deposited material should be resisted.

Figure 22: Excellent, complex braided-channel habitat. A huge variety of flow depths (ranging from less than an inch down to around 20ft) are present in this section. Similarly, flow direction and speeds are also equally variable. As a result, there is fantastic habitat for a whole range of coarse and game fish species through all of their varied life-stages.

4. Recommendations

4.1 Tackle invasive plant species

Large portions of this survey highlight a range of serious problems associated with invasive, non-native plants. In fact, many other benefits that could potentially be gained (such as improved canopy management) will not be possible before control is established over non-native plant infestations.

It is important to recognise that control, rather than eradication, is the realistic aim. Biologically speaking, establishing and maintaining a level of control will be a near identical outcome to a situation of complete eradication. This is a completely different consideration from the requirements of land developers – where eradication is mandatory (and consequently far more expensive).

The club is already aware of the legal requirements for herbicide applications adjacent to watercourses and are arranging funding to formally train and certify additional club members for invasive plant control duties. However, current plans to focus mainly on sprayed application of herbicides may not be the most efficient or cost-effective means of achieving control along the club's waters.

There are significant downsides to sprayed applications:
- It hits non-target (native) plant species just as hard as the invasive targets
- Overspray into water can harm aquatic life (glyphosate-based herbicides are denatured rapidly in soil – but persist in harmful forms for longer in water)
- Compared to more direct methods, spraying can take many more, repeat applications before control is achieved over target invasive plants (all the while, continuing to knock back native flora)

For these reasons, the purchase of (and associated training/certification for) stem-injection kit could be a valuable alternative strategy. With appropriate personal protective equipment and training – stem injection can be used to successfully control giant hogweed, Japanese knotweed and hybrid Japanese x giant knotweed. This is due to the following reasoning:

- Uptake of the herbicide is much more effective through direct injection than via foliar absorption (this leads to a lower requirement for re-application in order to gain control)
- Fewer applications lead to achieving control over a shorter time-span for individual stands – this can offset some (or perhaps even all) of the more labour intense process of individually injecting plant stems compared to the relative ease of blanket spraying
- Non-target plant species are unaffected – again reducing the time taken to transform a section of riverbank from infested to diverse, native flora (and also minimising the duration that banks are left denuded of vegetation and highly vulnerable to erosion)
- Aquatic life is not at risk – so long as accidental spillage is prevented

4.2 Undertake rotational coppicing of woodland to break up the current "flat" mature canopy structure

This can only be initiated in areas in which invasive plants are under control. Under these conditions, undertaking a light rotational coppicing regime will help to promote a varied and attractive understory. In addition, the low, bushy regrowth of bankside trees may automatically generate useful cover for fish. In the event that an additional helping hand is required, the young regrowth can be easily trained such that it projects over and into the margins of the watercourse. Aiming to take a scattered distribution of around 10% of trees each year over a 10-year period would result in an excellent, staggered age-structure of tree canopy.

In addition, the larger woody materials arising from coppicing activity will provide excellent raw material for in-stream installations such as tree kickers. A specific opportunity for tree-kicker installation exists at SD80158 08438 (Fig. 2). An illustration of this technique is given in Fig. 23 and a full demonstration provided in this video: https://vimeo.com/72720550.

The braided steel cable used to attach the cut tree-stem to its stump is secured by means of purpose-built cable crimps and the orientation of kickers parallel to the bank during high flows makes them extremely stable. Having only one end of the tree tethered allows the crown to move up and down in response to changing flow levels.

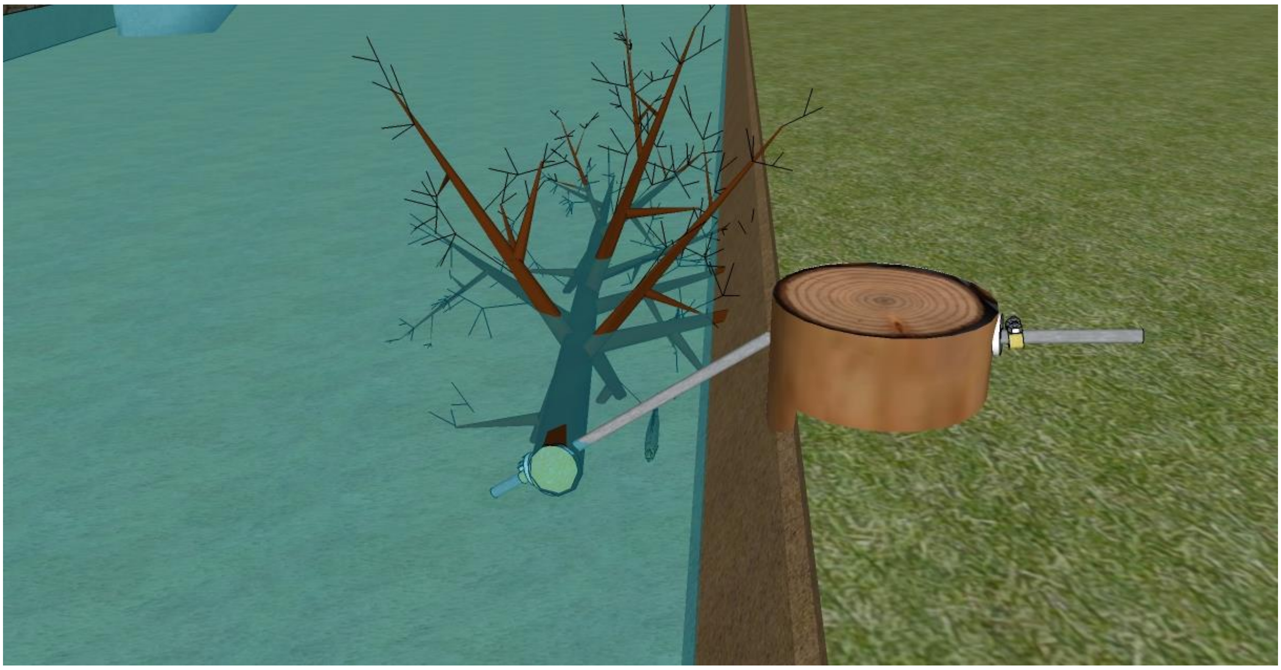

Figure 23: Example of tree-kicker installation using cable crimps and braided steel cable

Continuing and extending the practice of hinging young saplings to produce areas of submerged marginal cover will be incredibly valuable. This could be applied to coppice-regrowth (as mentioned above), but should also be considered as part of tree-planting efforts along the margins of the river. Rotational coppicing, combined with hinging will not only improve habitat – it will also ensure that appropriate access for anglers to the watercourse is maintained. Wherever possible, ensure that significant proportions (i.e. around 50% or more) of the total volume of the crowns of hinged saplings are submerged at normal flow-levels.

4.3 Consider the introduction of scattered large boulders in the reach where bed material has been pulled back into the margins

Whilst working towards an improved marginal woodland and native understory vegetation structure (and associated increased volume of submerged, structural materials) – it may be beneficial to create some instant structural diversity. If there is local stone available in the size range 70 cm to 2m along the longest axis, then introducing a scattered belt of such material may be an aid to the recovery of complexity within this simplified reach.

4.4 Use revetments that do not promote eddying flows that will exacerbate bank erosion

The ultimate aim of improving river corridor vegetation structure (and associated appropriate encroachment into the river channel) will be to provide any necessary management of bank-erosion. However, in cases where it is deemed vital to act before the necessary vegetation can establish, it may be helpful to construct some bank revetments. Where water-depth allows, using techniques such as pinned log berms with back-fill material of either brash or stone can be successful (e.g. Figs. 24 and 25).

Figure 24: Log and brash revetment used on the highly erosive sections of the River Colne in East Lancashire. The logs are pinned using 2-m long sections of 19-mm diameter steel reinforcing bar.

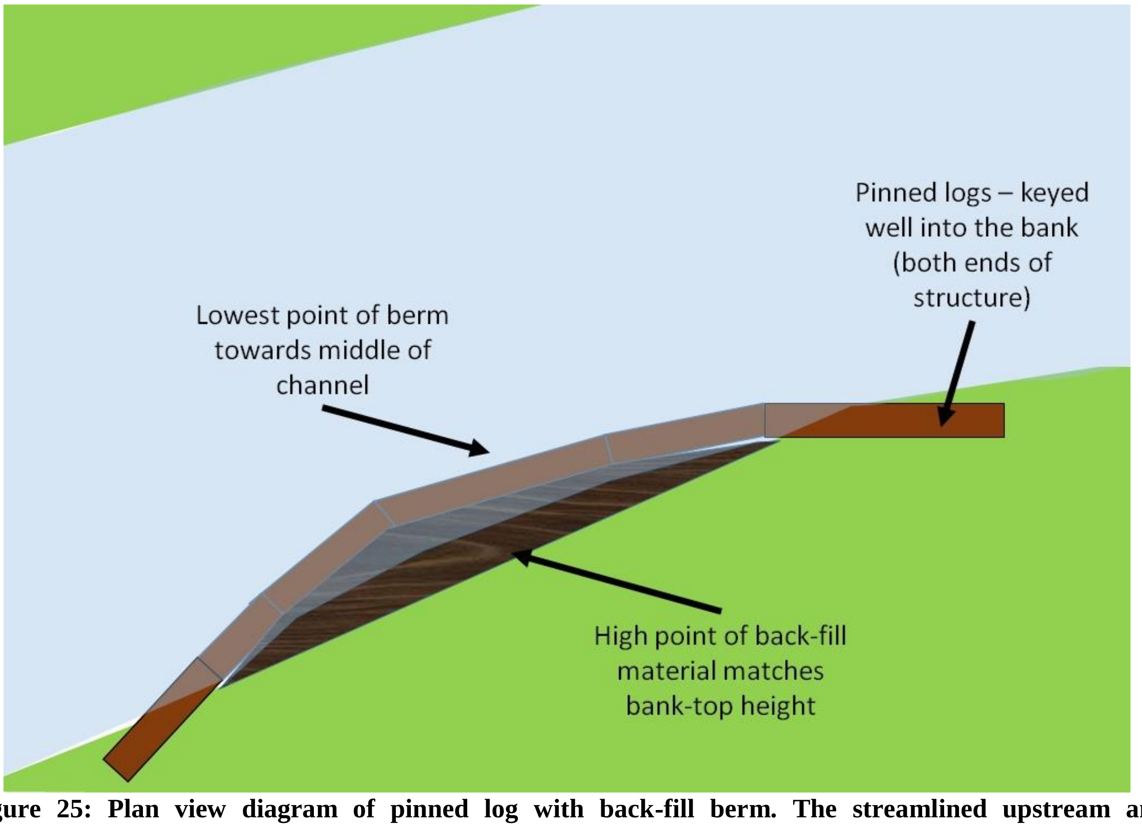

Figure 25: Plan view diagram of pinned log with back-fill berm. The streamlined upstream and downstream junctions with the riverbank (which are keyed well into the bank for additional security) prevent erosive eddies forming. Ensuring that the profile of the berm tapers (in the "pasty-shape" mentioned on pages 10-12) from high to low from bank to mid-channel helps to prevent spate flows cutting behind the structure.

A well-placed tree kicker can also be an excellent means of stabilising eroding banks. The proviso is that there is a suitably robust anchor point available to which the cable can be attached.

4.5 Permissions

As with all works within a main river channel (or within 8 m of the channel boundary), many of the suggested habitat works in this report will require permission from the Environment Agency (EA). There are often additional permissions that may need to be considered. An introductory (but not exhaustive) guide to seeking and obtaining the correct permissions for river corridor habitat works is provided here: https://vimeo.com/55877140. Ongoing contact with local EA personnel will also help to identify permissions requirements.

5. Making it Happen

Along with continuing the existing impressive works carried out by the (growing) club membership and new partnerships being developed with the Canal and Rivers Trust – it may be possible for the Wild Trout Trust to provide support in carrying out recommendations in this report. A number of tasks within the report (such as tree kicker installation and berm-construction) could be demonstrated by way of a "Practical Visit" training event. Demand for Practical Visits is very high, and arranging one is subject to the availability of staff. Aside from a contribution to mileage costs of WTT staff members, the materials and training during Practical Visits can be provided free of charge to the recipients (see Acknowledgement below).

Acknowledgement

The WTT would like to thank the Environment Agency for supporting the advisory and practical visit programmes in part through rod-licence funding.

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.