# River Chew, Publow

**An Advisory visit by the Wild Trout Trust Feb 2013**

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## Introduction

This report is the output of a Wild Trout Trust visit undertaken on the River Chew at Publow near Bristol. The visit was requested by Mr Dave Wiltshire who is the Secretary of the Chew Fly Fishing Club (CFFC). The visit was primarily focussed on options to improve the river habitat for wild brown trout *(Salmo trutta)* and sympathetically manage the river and banks.

Comments in this report are based on observations on the day of the site visit and discussions with Mr Wiltshire.

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

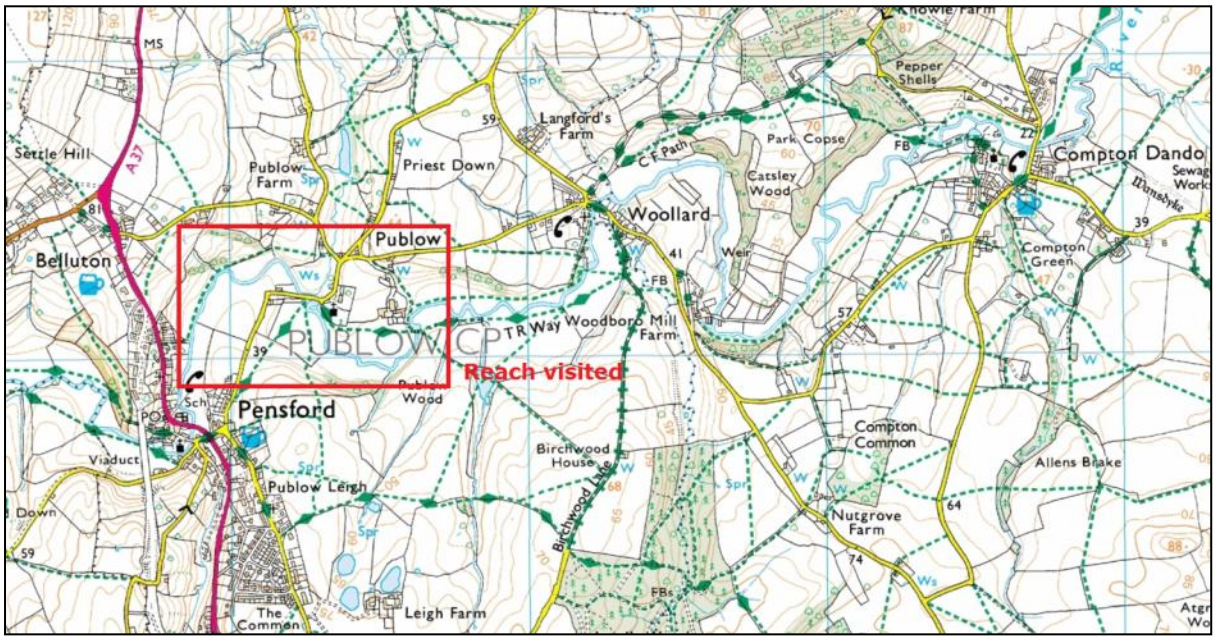


Figure 1: Map showing the section of the River Chew visited

## Catchment and Fishery Overview

The River Chew rises from springs at Chewton Mendip in the Mendip Hills and flows over a relatively steep gradient north to Litton where it is dammed into two online lakes at Litton Reservoir. The reservoir is owned by Bristol Water and is stocked with hatchery raised rainbow trout *(Oncorhynchus mykiss)* and brown trout *(Salmo trutta)*. After discharging from Litton Reservoir, the Chew flows as

a small stream, collecting more flow from Mendip-fed tributaries over a gradually shallowing gradient until it is once again dammed at Chew Valley Reservoir (also stocked with trout by Bristol Water). Chew Valley Reservoir or Chew Valley Lake as it is known locally is famous for both trout and pike *(Esox lucius)* fishing. A spawning population of rainbow trout are reported to run the Upper Chew from the lake.

The Chew flows out from the lake over a spillway. An additional discharge is also piped into the river which flows even when the spillway is dry. The reservoirs supply water to the local area including much of southern Bristol.

Flowing through Chew Magna, Stanton Drew and Pensford the remnants of historic textile mills impound the river in a few locations and fragment the river habitat. The Chew meanders through a wide valley towards its confluence with the Bristol Avon at Keynsham.

The geology of the local area causes the Chew to be prone to spate flows. The Mendip Hills are predominantly pervious limestone (karst) whilst the valleys to the north consist of alluvial fan deposits of clay, silt and sand over mudstone bedrock. Sheet run-off flowing over the clay fields during the locally infamous flood of 1968 carried so much debris into the river that a number of bridges were destroyed.

The 1968 flood swept away cars, demolished homes and caused three fatalities in Keynsham.

The River Chew is reported to support a broad range of fish species including trout, dace *(Leuciscus leuciscus),* Chub *(Leuciscus cephalus)*, perch *(Perca fluviatilis)*, roach *(Rutilus rutilus)*, pike *(Esox lucius)*, bullhead *(Cottus gobio),* brook lampey *(Lampetra planeri)*, and eel *(Anguilla anguilla).* The flashy nature of the river makes it quite likely that juvenile fish from upstream populations are often washed downstream. However, the various impoundments including the major dams at Chew Valley and Litton Reservoir mean that the headwaters are cut off from resident wild brown trout attempting to run upstream to spawn. This may account in part for the relatively intensive stocking regime of the Chew over recent decades. Fish passage improvements have been made to better connect the Chew with the Bristol Avon at Keynsham.

The flashy nature of the river retains a naturally active geomorphology which continues to shift and shape the river during spates. This allows the river to regularly carve out new habitat niches and retain a relatively high level of physical diversity. Where gravel seams are present in the banks, a steady supply of fresh gravel is able to enter the river. This could be a particularly important process as rivers with on-line reservoirs can often become depleted of gravel from upstream. Additionally, coarse bed material from demolished historic mills and bridges provide refugia for invertebrates and small fish such as bullhead and stone loach *(Barbatula barbatula)*. In places, rubble from demolished structures or disused fords helps to create riffle and glide habitat which may help support resident populations of flow-loving, gravel spawning fish.

The Chew Fly Fishing Club's waters are at Publow, downstream of Pensford. The river is not as intensively stocked as sections upstream and is reported to support a good population of wild brown trout.

**Habitat Assessment**

At the upstream extent of the reach visited, the river flows along the base of Pensford Hill. The river is incised with steep banks possibly as a result of dredging works undertaken in the aftermath of the 1968 flood. Where trees line the banks, erosion is checked by the resistance of their root systems, but where long stretches of the bank are un-wooded, the steep slopes provide little opportunity for vegetation to establish and extensive erosion is taking place.

Along with helping to protect the steep banks from erosion, the bankside trees provide shade over the river. Concerns over the possible effects of hot and dry periods, possibly exacerbated by the impact of climate change, have led to the development of the Environment Agency's *Keeping Rivers Cool* guide.

http://www.wildtrout.org/sites/default/files/news/Keeping%20Rivers%20Cool_Guidance%20Manual_v1%20%2023%2008%2012.pdf

This advocates the use of shade from riparian trees for helping to regulate water temperature for freshwater species such as trout.

Trees are undoubtedly important for both shade and erosion protection but too many bankside trees can be a problem. On straightened sections of river, banks densely lined with trees can sometimes provide too much erosion resistance and inhibit the natural geomorphology of the river. Additionally, too much riparian shade can inhibit the growth of aquatic and marginal plants, limiting in-stream productivity and impacting on the ecosystem food web.

At present a roughly 50:50 balance of direct sunlight to dappled shade is recommended to keep rivers cool yet productive.

**Figure 2: Bankside trees protect the banks and provide shade. However, a diverse range of light conditions is best for the river**

The land on the right bank is used for arable farming and on the day of the visit appeared to have been recently ploughed. A narrow 'buffer strip' of rough grassland is situated at the top of the bank which may help to filter run-off from the ploughed field. However, considering the geology of the area, it is reasonable to infer that arable farming within the floodplain could be a diffuse source of excess fine sediment into the river. Erosion of the steep, river cliffs is also a source of excess fine sediment. Excess fine sediment can smother gravels and limit spawning opportunities for gravel spawning fish. Fine sediment can also suffocate eggs laid in the gravel.

Steep river cliffs can provide important habitat for sand martins *(Riparia riparia)* and kingfishers *(Alcedo atthis)* and be a source of gravel into the river. This should be taken into consideration when deciding whether or not to repair erosion.

**Figure 3: The steep cliffing bank and ploughed field may both be inputs of excess sediment into the river.**

In places, young relatively recently pollarded trees provide low-lying overhead cover for trout as well as helping to hold the banks together and replace older trees that fall. Adult trout favour low overhead cover over deep pools. Small, low-lying trees are extremely important in helping a reach to hold adult wild trout.

**Figure 4: Low-lying tree cover over deep water can provide excellent cover for adult trout**

A short distance downstream a fallen tree was lying across the channel. Fallen trees are natural part of the river ecosystem. For millions of years trees have fallen into rivers forcing the flow around them and re-shaping the channel. Freshwater river species have evolved around this process and fallen trees and other large woody debris (LWD) provide a variety of habitat niches.

Woody debris is also important for invertebrates. Shredding invertebrates can utilise woody material as a food source whilst other invertebrate communities will graze on algae growing on the wood. Emergent woody material can also be an important interface between the aquatic and terrestrial habitats for fly life with life stages in both.

Where trees lie across the channel they force flows underneath causing lateral scour to shape deep pools in the bed. A deep scour pool with overhead cover is prime territory for adult trout. The material scoured from the bed will be deposited a short distance downstream and naturally sorted depending on its size (and mass).

**Figure 5: A fallen tree lies across the channel providing excellent cover for trout and habitat and food for invertebrates**

Clean, sorted and well oxygenated gravel, particularly on the ramp at the tail end of a pool provides ideal spawning habitat for trout.

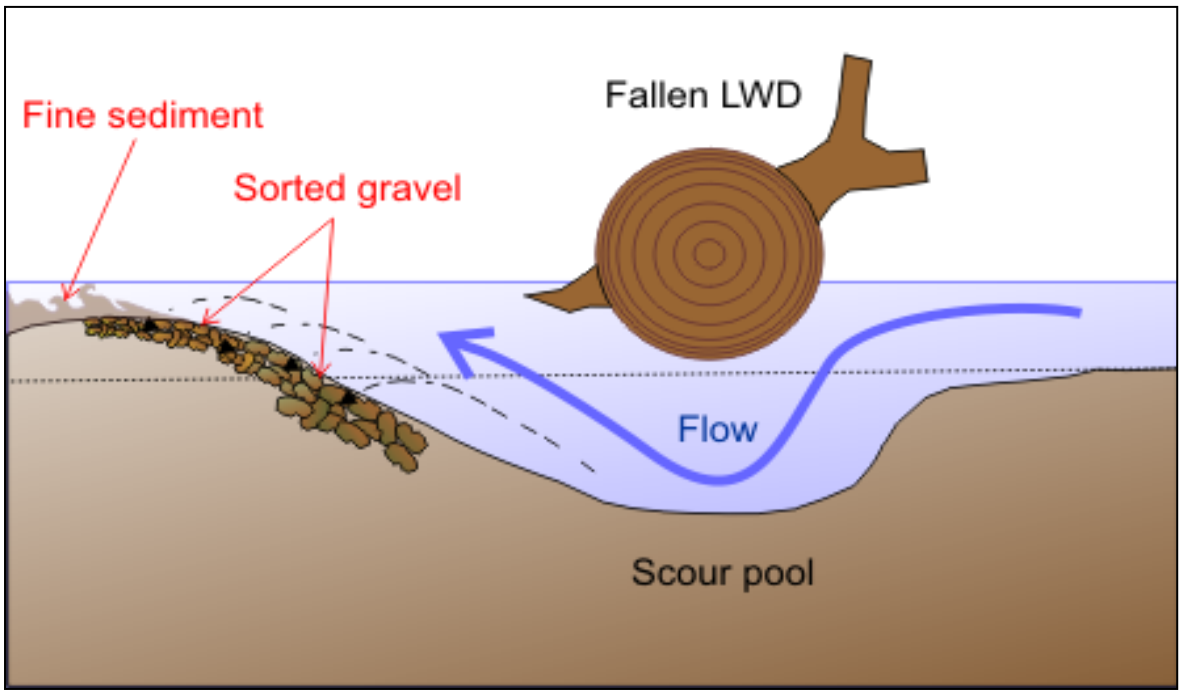


**Figure 6: An illustration of how fallen LWD can scours a pool and naturally sorts bed material**

Brushy 'coarse woody debris' (CWD) is also extremely important for fish. Fallen branches and brushwood provide important refuge for juvenile fish from predators both above and below the water. A good example of CWD habitat was

observed trailing from the Right Bank (Fig 7 below). This type of habitat can be easily reproduced by hinging (a technique used in hedge laying) small trees into the channel.

**Figure 7: CWD habitat providing protection from predators for juvenile fish**

Brushwood is also important for managing fine sediment. As water flows through a dense matrix of brushy material, the flow is slowed and fine sediment is allowed to drop out of suspension. Over time a berm of fine material will develop in the lee of the brushwood whilst the adjacent free-flowing channel is 'pinched' causing faster flows that keep the bed scoured clean. The separation of clean, fast flowing open water and the slack depositional zone introduces greater habitat diversity.

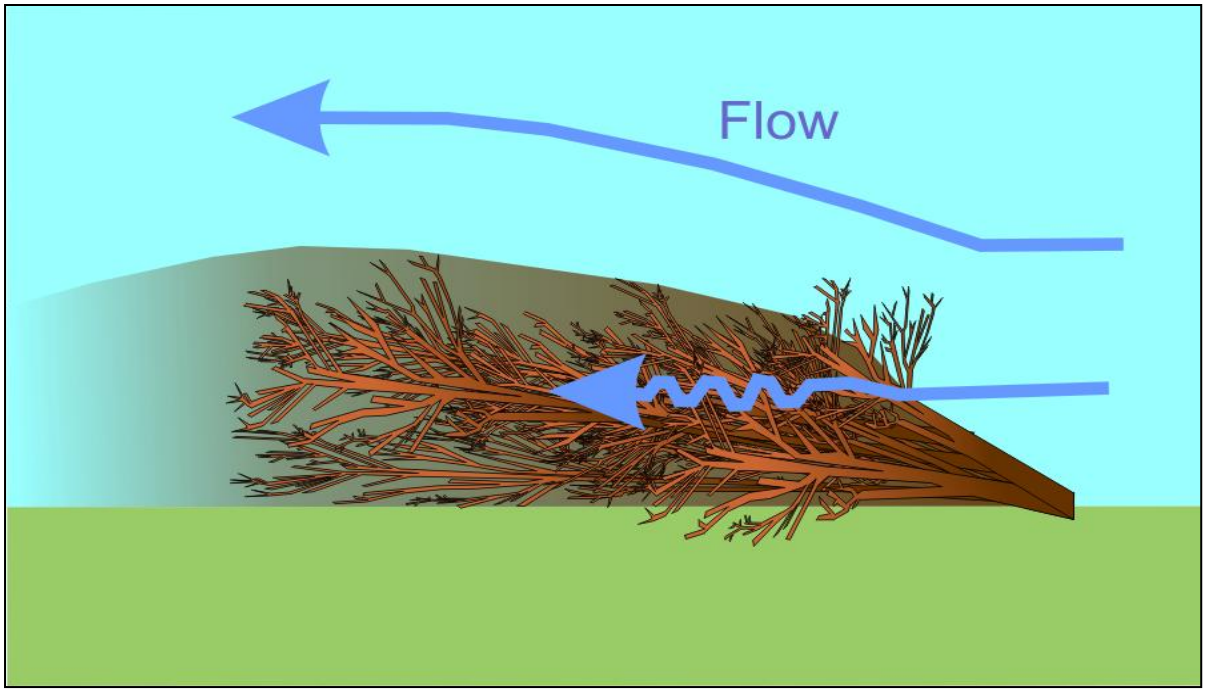


**Figure 8: A bird's eye illustration of how CWD can naturally manage fine sediment**

A weir under the bridge at Publow Church is thought to have once held up a head of water to power a mill at Church Farm. The weir is now passable for fish via the derelict spillway under the main arch of the bridge. The weir has an impounding effect on the river upstream, slowing flows and creating a more uniform habitat. The effect is relatively minor compared to other weirs on the Chew and the heritage value of the weir (and its popularity with local people) is such that altering the structure may be impractical.

The weir pool downstream of the bridge creates a dynamic environment that shifts and changes shape with each spate flow. This section of river provides a diverse range of habitat with great variation in flow velocity, depth and substrate.

Figure 9: The weir pool and bridge at Publow Church

Downstream of the weir pool the river is shallower and generally faster flowing than upstream. Tree cover is mostly appropriate and the active geomorphology of the river provides good variation in depth and a naturally sinuous channel provides some good diversity of flow. The river is sporadically fenced from grazing livestock with some sections of fence in good condition but some sections allowing grazing livestock close to the bank.

A well-fenced upper bank allowing a wide buffer of rough vegetation is important for the health of the river. Rough grassland at the top of bank is valuable for fly life such as may fly (Ephemeroptera) and caddis (Trichoptera) as a sheltered area to rest after hatching. Rough riparian grassland can be particularly important for mayfly as a habitat to hatch from subimago to adult form.

A buffer of un-grazed grassland is also important for limiting soil compaction and creating a natural filter for surface water run-off. Often the most practical option is to fully fence the river but include occasional gates to allow livestock into the buffer strip once or twice a year to help control invasive species such as Himalyan balsam *(Impatiens glandulifera)*.

Keeping livestock out of the river is also good practice for helping to control erosion. Bank poaching by cattle and browsing of emergent plants and tree saplings can leave banks vulnerable to erosion and can lead to the channel becoming over-wide and uniform.

**Figure 10: A fenced buffer at the top of the bank provides a number of habitat advantages**

Bankside crack willow *(Salix fragilis)* can sometimes split and collapse into the river, introducing overhead cover, LWD habitat and helping to deflect and diversify flows. However, where LWD could pose a flood or erosion risk it may be prudent to trim back some branches ensuring 2/3 of the channel remains free-flowing and secure the stump with some long sweet chestnut stakes and fencing wire.


Figure 11: Trimming and securing can be an effective alternative to complete removal

Trees rooted at the toe of the bank provide good lies for adult trout. Flows are forced under the roots and scour a pool where fish benefit from both overhead cover and the shelter of the roots. Often the river can begin to cut its way around the back of the root ball and erode the bank. If left unchecked this can cause the tree to become unstable and topple over, pulling out a large chunk of bank. To prevent this from happening, and preserve the trout holding habitat, the tree can be pollarded or hinged downstream. This will reduce the leverage acting on the roots whilst also preserving the habitat. Tightly packing the eroded bay behind the stump with brash from the tree works and securing with wire and posts could also help to reduce the rate of erosion.

**Figure 12: Undercut roots provide great habitat but if the tree topples there is a chance it may tear a hole in the bank**

A formal cattle drink on the left bank allows cattle down to the water. Formal cattle drinks can sometimes help to provide shallow bay habitat important for coarse fish fry. However, the bottom of the cattle drink is open, allowing cattle to wander around the river when levels allow. This could be a point source of excess fine sediment and nutrient into the river. Alternative options that do not require cattle to access the river should be discussed with the farmer. 'Pasture pumps' are small portable devices that do not require power and allow cattle to pump their own water supply up to 50 metres.

Photovoltaic (solar) pumps and 'ram pumps' can also be a good alternative to cattle drinks and like the pasture pumps require no mains power to operate. All of these devices have allowed farmers to water cattle where riverbanks are completely fenced off. A cautious approach may be to install a device in combination with a gate at the top of the cattle drink to allow access to the river in case of malfunction.

**Figure 13: Alternatives to the cattle drink may be worth discussing with the farmer.**

As the river flows alongside Publow Wood the right bank becomes heavily shaded by the woodland. Some rotational tree works to thin out the woodland and introduce a greater diversity of canopy heights would provide a greater diversity of light conditions. In addition, some of the bankside trees could be hinged or pollarded to allow more light into the channel. Where possible, the low-lying branches should be left in place. As well as providing overhead cover, low lying branches also supplement the river with a steady supply of leaf terrestrial beetles and bugs that will occasionally drop into the river. This can make up an important component of trout diet in small spate rivers.

**Figure 14: Low lying branches provide overhead cover and can help supplement trout diet with occasional terrestrial invertebrates**

Hinged trees and pollarded limbs could be fixed against the toe of the bank to help control erosion.

**Figure 15: Trees simply felled or hinged into the channel and fixed against the bank could help stabilise bank slips and control erosion**

Pollarded limbs could also be cabled to their stump as 'kickers' which swing out into the channel during low flows but are pushed back against the bank during

spates. These kickers or 'sweepers' as they are sometime known can be a useful technique for introducing woody debris to high energy rivers where woody debris can be difficult to fix in place. Kickers can also be very quickly and easily installed.

Figure 16: An example of a tree limb cabled back to its stump to form a 'kicker'

As the Chew flows towards Church Farm it passes under a farm bridge and opens out into a wide pool. Options may be available to enhance the pool with fixed LWD to provide overhead cover. Additionally, a marginal shelf constructed from densely packed brushwood could be installed out of the main flow to introduce additional marginal habitat. These options could introduce new lies for trout and offer the club's rods a focus to aim their flies at.

Downstream of the pool the river flows slightly faster over a generally shallower bed. The remains of small block stone weirs, probably installed to hold up water during low flows, have become dismantled. The practice of impounding the river in a series of small weirs to maximise fishing during low flows tends to lower the quality of the habitat by inhibiting natural geomorphology and creating uniform conditions.

The best way to retain depth during low flows is to maximise flow diversity in order to scour natural pools and encourage the river to develop a two-stage

channel with a low-flow channel following the natural thalweg of the river (Fig 18).

**Figure 17: The wide pool near Church Farm.**

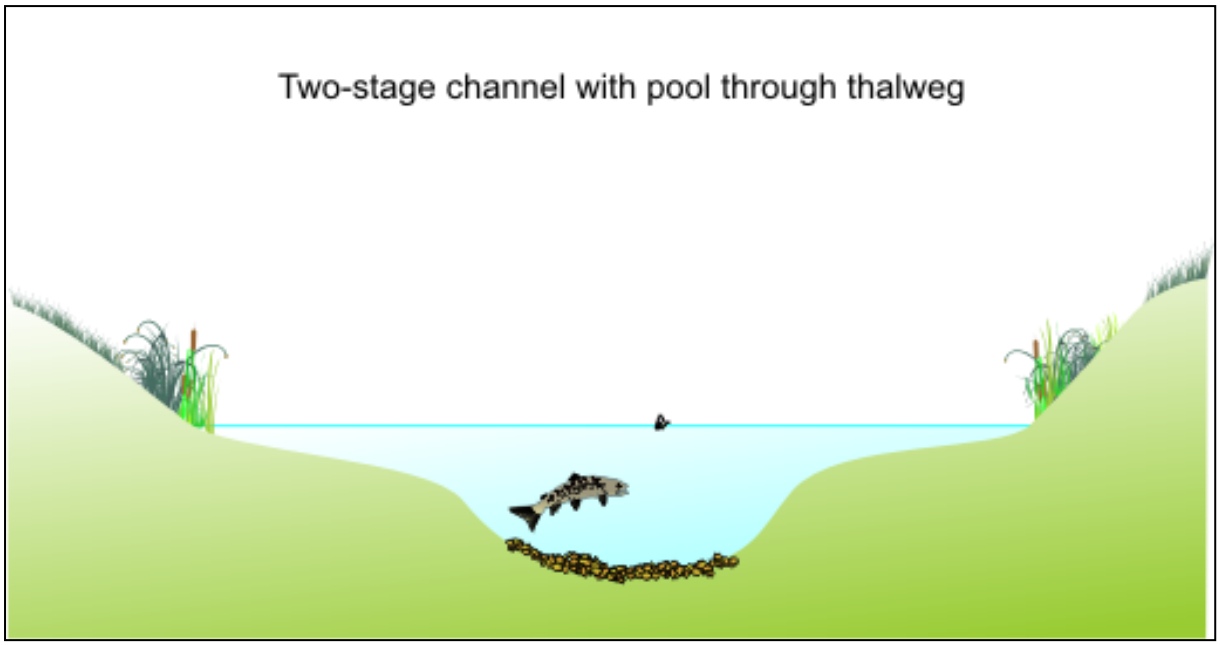


**Figure 18: An illustration of a two stage channel cross section with a deeper 'low-flow' channel holding trout during low flows.**

**Recommendations**

In order to progress the River Chew at Publow towards reaching its full potential as a rich and diverse habitat for gravel spawning, flow loving fish such as wild brown trout, the following actions are recommended:

1. Engage with local land owners to discuss the possibility of establishing a fully fenced buffer strip either side of the river with occasional gates to provide access for periodic grazing or clearance works. Funding for fence building may be available to land owners through Catchment Sensitive Farming or Higher Level Stewardship grants from Natural England. Opening a dialogue with Natural England on the subject of fencing is recommended.

2. Where woody debris naturally enters the channel, consider leaving it in place as a habitat feature. If the debris presents a flood or erosion risk, or substantially impacts on angling, consider trimming it back or repositioning it and fixing it in place with chestnut stakes and fencing wire. For more information see the WTT website:
   http://www.wildtrout.org/sites/default/files/library/Woody_Debris_Apr2012_WEB.pdf
   If in doubt, liaise with the local Environment Agency flood defence team.

3. Set up a programme of tree works to help balance light conditions over the river, introduce more low-lying cover and help control bank erosion where required. Where trees are sparse, consider planting low, shrubby trees such as goat willow *(Salix caprea)* and hawthorn.

4. Use woody material arising from the tree works to help control erosion issues, introduce woody debris habitat features and flow deflectors.
   Where bank slips/slumps are a problem, a long piece of LWD can be fixed to the bed at the toe of the bank and the slump area packed with brushwood. This will slow water velocity across the slip and encourage deposition whilst also providing a habitat for small fish and invertebrates.
   If possible plant the slip with marginal species such as sedges *(Carex spp.)* to help stabilise the friable soil.

Additionally, consider driving whips or stakes of live willow into the slip area. If they successfully take root, the saplings will quickly help to hold the bank together. This technique is best undertaken during late winter/early spring when the willow is dormant but can often be successful throughout the year.

It is important to take into account the annual maintenance a live willow bank repair will require before undertaking such works.

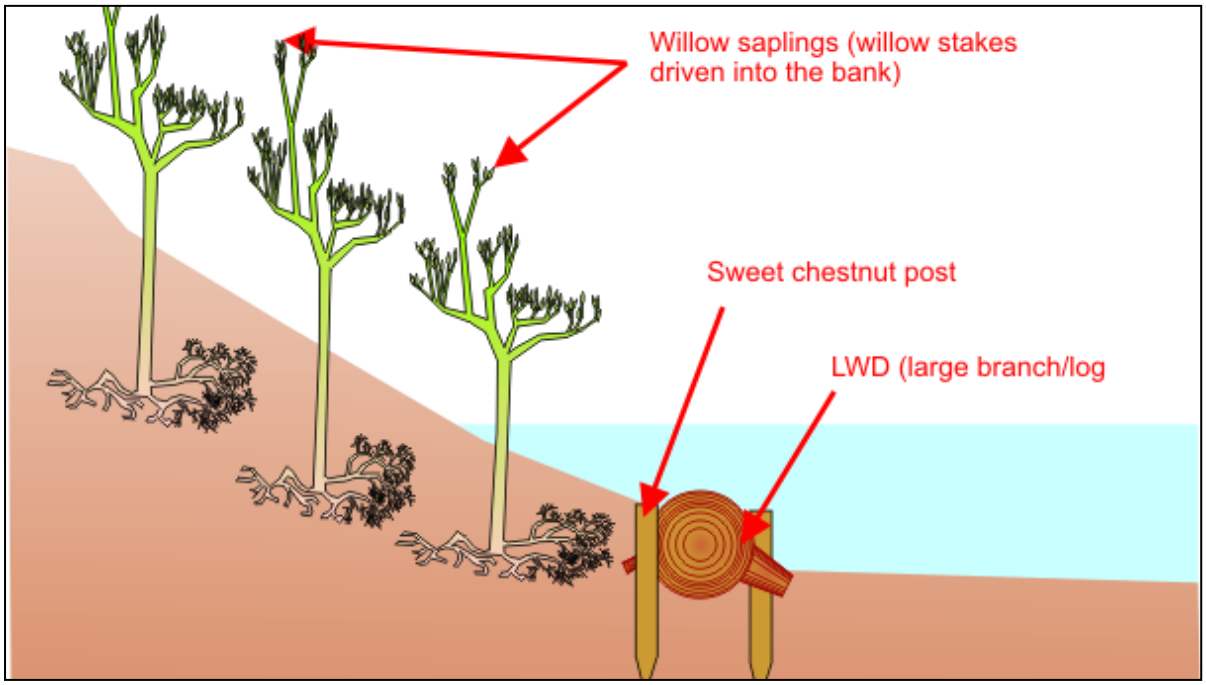


Figure 19: An illustration of a simple live willow bank repair

Considering the flashy nature of the Chew, simple cabled kickers could provide low-risk habitat enhancements.

5. Engage with the club's anglers and discuss the option of managing a completely wild fishery. Large fish could still be stocked into the club's still waters providing anglers with a 'catch and kill' option but the river at Publow could remain a 'catch and release' wild fishery. This would have significant benefits for the river ecosystem and could provide significant cost savings for the club as the cost of stocking continues to rise. Additionally, club's waters could serve as an example for other club's on the Chew that may galvanise other habitat improvements locally.

6. Consider contacting and visiting other local fishing clubs that have decided to manage a wild fishery. The Avon and Tributaries Angling Association's water on the Wellow and Cam Brook's may have some parallels with the Chew.

**Making it Happen**

There is the possibility that the WTT could help to start a project via a Project Proposal (PP) or a Practical Visit (PV). PV's typically comprise a 1-3 day visit where approved WTT 'Wet-Work' experts will complete a demonstration plot on the site to be restored.

This will enable project leaders and teams to obtain on the ground training regarding the appropriate use of conservation techniques and materials, including Health & Safety, equipment and requirements. This will then give projects the strongest possible start leading to successful completion of aims and objectives.

Recipients will be expected to cover travel and accommodation (if required) expenses of the PV leader.

There is currently a big demand for practical assistance and the WTT has to prioritise exactly where it can deploy its limited resources. The Trust is always available to provide free advice and help to organisations and landowners through guidance and linking them up with others that have had experience in improving river habitat.

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