River Frome, Bovington, Dorset

An Advisory Visit by the Wild Trout Trust October 2014

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Introduction

This report is the output of a Wild Trout Trust visit undertaken on a carrier of the River Frome at Bovington Camp, Dorset (national grid reference (NGR) SY 8345 8765). A walk-over of the site was requested by Maj. Jeremy Hann, who manages the Bovington Camp fishery. The visit was primarily focussed on assessing habitat for wild trout (*Salmo trutta*).

Comments in this report are based on observations on the day of the site visit and discussions with Maj. Hann. Throughout the report, normal convention is followed with respect to bank identification i.e. banks are designated Left Bank (LB) or Right Bank (RB) whilst looking downstream.

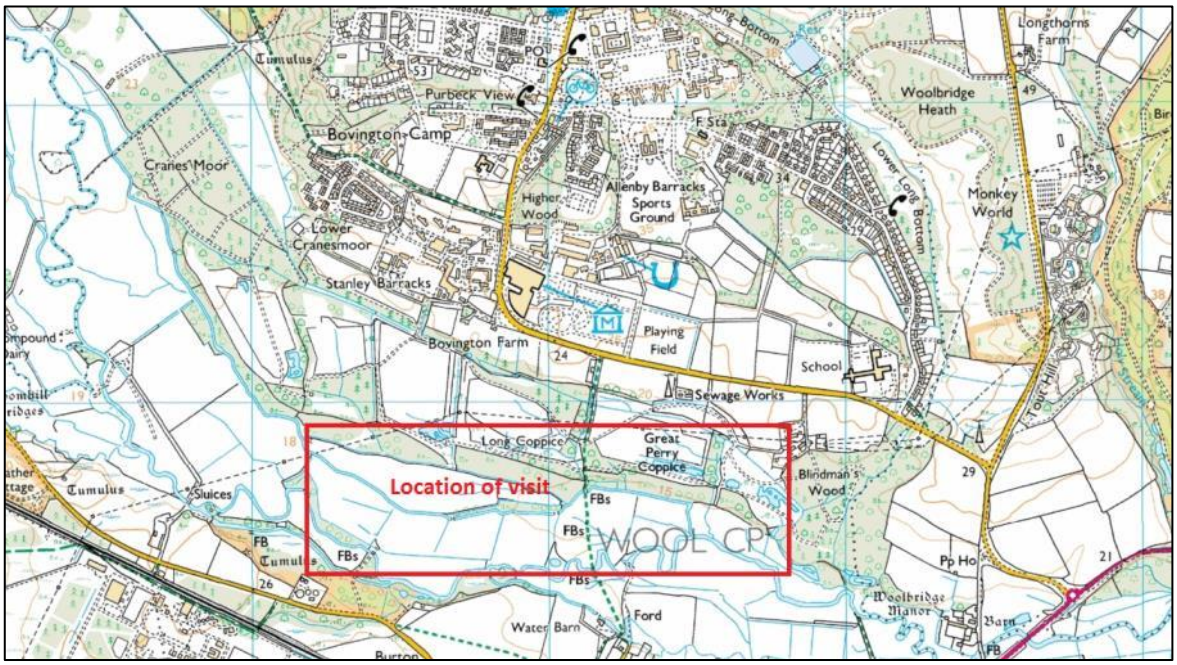

Figure 1: Map showing the location of the water visited

Catchment and Fishery Overview

The Frome is a chalk stream that lies entirely within the county of Dorset and is the county's second longest river. The river drains a catchment of 454 km^2 (181 square miles) dominated by a white chalk geology with measures of grey chalk in the upper catchment and sedimentary sand, clay and silt in the lower reaches. The Frome is famous for trout and salmon fishing. However, salmon stocks in the Frome have crashed in recent years and research is ongoing as to the exact causes and methods to help the population recover. Like most of the southern chalk streams the Frome has undergone significant historical modifications for water meadows, milling and land drainage.

The Frome is the most westerly example of a major chalk stream in Great Britain. It also has a slightly different ecology to the nearby Rivers Test and Itchen owing, in part, to the changes in underlying geology through its course. As a result, the Frome is a Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC).

Much of the river and some of its tributaries are failing their targets for fish and macrophytes (aquatic plants) under the Water Framework Directive (WFD). Channel modifications, such as barriers to fish passage and poor land management leading to reduced habitat quality, are likely to be significant drivers in the failure in fish stocks. Chalk rivers are extremely biodiverse environments supporting rich and diverse aquatic plant and invertebrate communities. Juvenile brown trout and salmon born in chalk streams benefit from an abundant and diverse diet which helps to promote rapid growth rates. However, high levels of calcium carbonate precipitate (known as tufa) can bind river gravels together and reduce the quality of spawning habitat, leading to reduced survival of eggs and young fry (alevins).

Table 1: Water Framework Directive information (from Environment Agency website)

Site details	
Waterbody Name	Frome Dorset (Lower) & Furzebrook Stream
Waterbody ID	GB108044009690
Management Catchment	Dorset
River Basin District	South West
Current Ecological Quality	Poor Status
Biological Quality:	
A characteristic or property of a biological element that is specifically listed in Annex V of the Water Framework Directive for the definition of the ecological status of a water body (for example composition of invertebrates; abundance of angiosperms; age structure of fish).	
OVERALL BIOLOGICAL QUALITY	Poor
Diatoms	Poor
Fish	Moderate
Macrophytes	Moderate
Macro-invertebrates	Good
General Physico Chemical Quality:	
OVERALL PHYSICO CHEMICAL QUALITY	Good
Ammonia	High
Dissolved Oxygen	High
pH	High
Phosphate	Good
Hydro Morphological Quality:	
OVERALL HYDRO MORPHOLOGICAL QUALITY	Not High
Hydrology	Not High
Morphology	Good
Specific Pollutants Quality:	
OVERALL SPECIFIC POLLUTANTS QUALITY	High
Ammonia	High
Arsenic	High
Copper	High
Iron	High
Zinc	High

Habitat Assessment

For the purposes of this report the water visited will be described from the upstream extent of the smaller carrier, to the confluence with the main carrier and downstream to the bottom of the reach visited.

At the upstream extent of the water visited the small carrier has at some point been artificially straightened. The straightening imposes a limitation on channel morphology, reducing the diversity of depth and flow conditions, which in turn impacts on habitat availability. In particular, shallow-gradient marginal habitat is scarce, limiting the abundance and diversity of marginal plants. Marginal plant diversity on the RB is significantly lower than on the LB. This is probably the result of the RB being unfenced whilst the LB is fenced to keep out grazing livestock. The LB is not devoid of marginal habitat however; what appears to be a derelict cattle drink on the RB towards the boundary with the next field downstream, has developed into a shallow bay and become colonised by reed sweetgrass (*Glyceria maxima*). This suggests that grazing pressure may have been more intense in the past (causing bank poaching) but has eased in recent years (allowing the poached bank to become colonised). (Figure 2).

Figure 2: The vegetated shallow bay in the derelict cattle drink.

The carrier though the upstream-most field and the next field downstream is lacking in woody habitat features (submerged and trailing logs and branches). The river ecosystem has evolved over millions of years around trees periodically falling into the channel. Fallen wood not only provides habitat and food for a range of fish and invertebrates but also helps to power the morphology of the river and increase habitat diversity.

Flows deflected around and/or over and under large limbs and trunks are locally accelerated and scour the bed and banks. This redistributes bed material and increases depth variation and bank sinuosity. This action can help to naturally 'sort' bed material as the finest particles are carried the furthest downstream whilst larger cobbles drop out of suspension sooner (Figure 3). The result is an area of gravel graded by size and swept clean of fine sediment. Well-sorted gravel at the tail of a scour pool is perfect spawning habitat for trout, especially if the pool has some overhead cover where fish can hold up for an extended period.

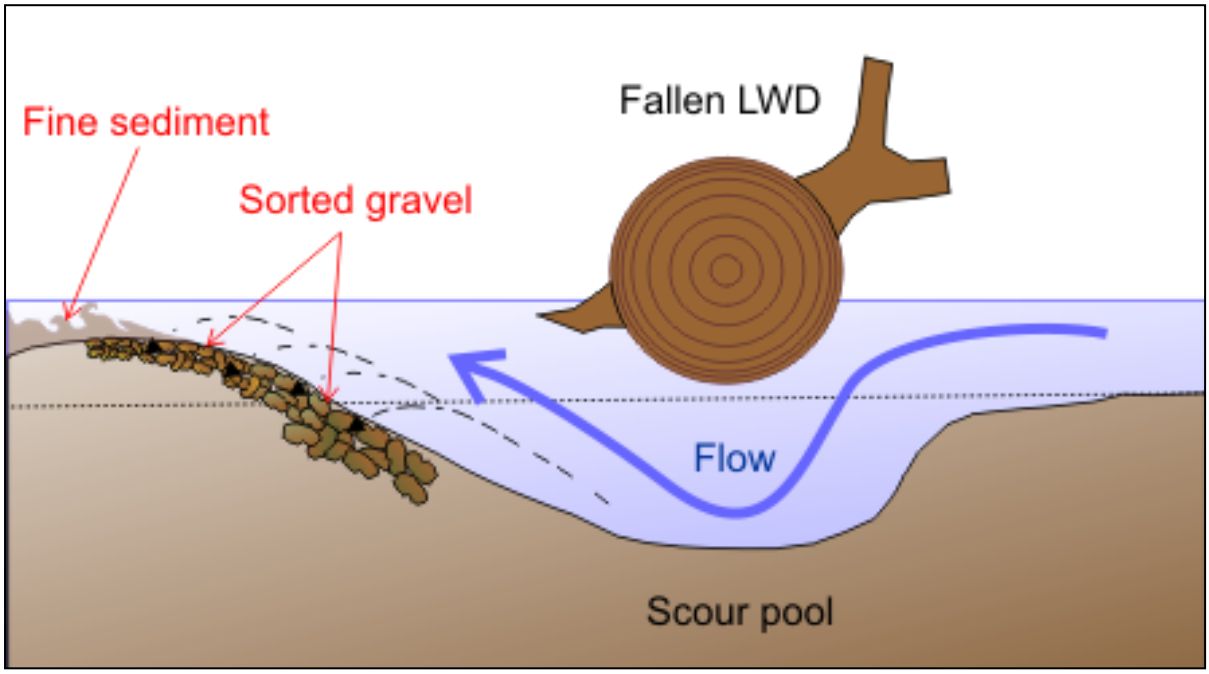

Figure 3: Longitudinal stream section showing that Large Woody Debris (LWD) across the channel can often result in the cleaner, well-sorted gravel

Coarse woody material in the form of branches and brushwood is also important. It locally slows flow, creating a depositional environment that traps fine sediment (Figure 4). This provides habitat for silt-loving species and marginal plants. It also provides excellent refuge habitat for juvenile trout and provides an area of slackened flow where trout can conserve energy and dart in and out of faster flows to snatch passing prey.

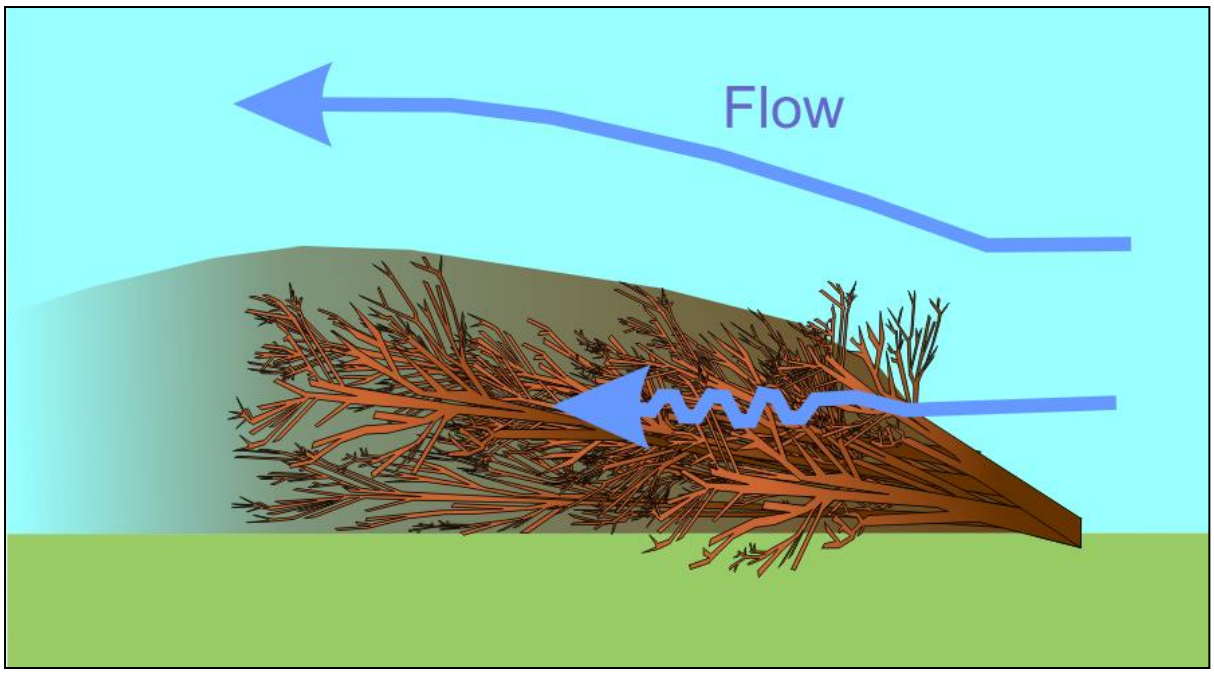

Figure 4: Plan view of a stream section showing that brushwood in the channel naturally slows flows and traps sediment.

The scouring effect of in-channel woody material helps to create a sinuous flume of fast-flowing water that meanders through the channel. Providing the bed is not too armoured (e.g. with tufa), this eventually scours a relatively deep trench in the bed which becomes the very bottom of the valley known as the 'thalweg'. This trench acts as a low-flow channel which allows the river to naturally self-narrow during low flows and retain both depth and water velocity (Figure 5). A river with a well-pronounced thalweg is said to have a 'two stage' channel.

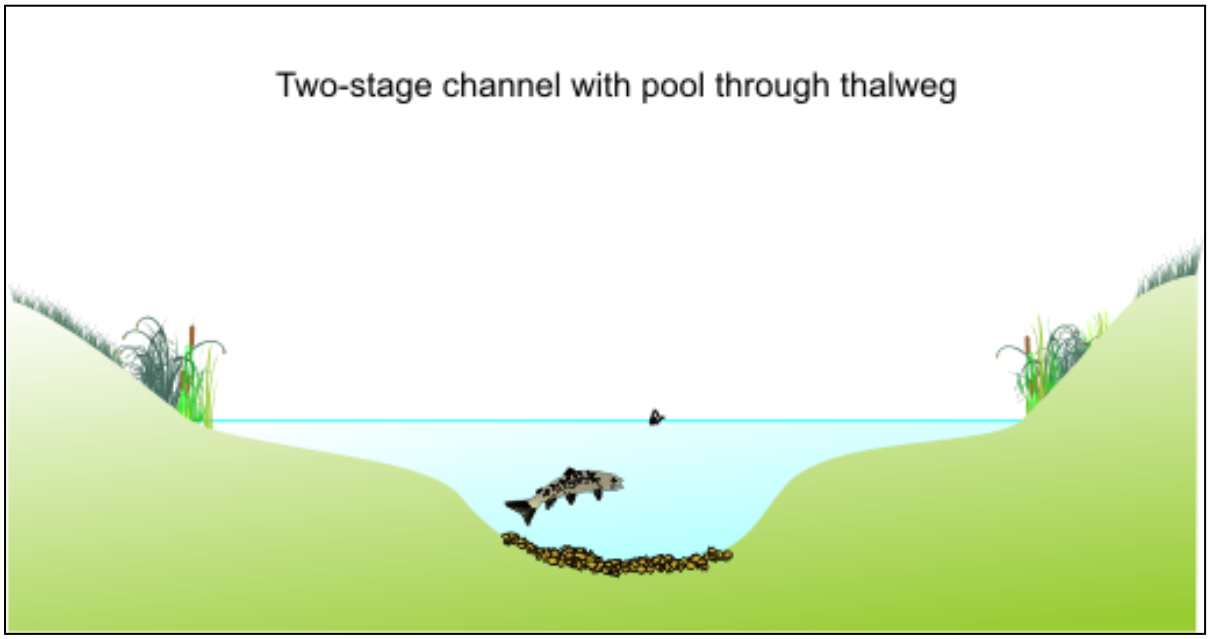

Figure 5: An illustration of a two stage channel cross section with a deeper 'low-flow' channel holding trout during low flows.

Dense tree cover on the LB through the downstream half of the second field may provide materials for the introduction of some woody habitat features (Figure 6).

Figure 6: Dense tree cover on the LB may provide an opportunity to won materials for in-channel habitat enhancements

Approximately mid-way through this field a large quantity of concrete blocks was observed evenly spaced on the bed (Figure 7). Why these had been placed in the channel was unclear. It is possible that the blocks have been placed in the channel to break-up the open water in an attempt to increase habitat for salmonid parr. It is also possible that the blocks have been placed in the channel as a precursor to introducing gravel to create a riffle, or in an attempt to anchor newly-planted water crowfoot (*Ranunculus* sp). Whatever the purpose of the blocks, they are an inappropriate material to introduce to the river and in any of the scenarios suggested above, large flint cobbles would be both more appropriate and function better. It is highly unlikely that the Environment Agency and/or Natural England would have consented the introduction of concrete blocks into a SSSI chalk stream for any purpose (with the possible exception of scientific research).

Figure 7: Regularly spaced concrete blocks installed on the bed of the river

Downstream of the blocks a deep pool has formed on a sharp left hand bend (Figure 8). This site is reportedly a good holding pool for trout (pers. comm. Jeremy Hann). Pools often naturally form where flows are accelerated around the outside of sharp bends. Material scoured out from pools is usually deposited a short distance downstream, diversifying depth conditions and often forming point bars or riffles. This site highlights the importance of sinuosity in helping maintain good habitat diversity in a healthy trout river.

Figure 8: A deep pool on a sharp left-hand bend is reportedly a good holding pool for trout

Immediately downstream of the bend a small debris dam was discovered which consisted of a small recently-cut tree limb snagged on some low branches (Figure 9). Debris dams are naturally occurring features that can have a variety of effects on habitat. They are sites where small, coarse woody material collects and decomposes, providing good habitat and food for invertebrates that in turn become food for fish. Debris dams can also increase bed scour and provide habitat refuge from predators. However, debris dams can also become obstacles to fish passage and impound flows, causing a reduction in habitat quality upstream and in some cases lead to increased flood risk. Whilst the structure observed did not appear to be causing any immediate problems, it may be worthwhile adjusting the structure so that it no longer blocks the entire width of the channel, perhaps moving the cut limb into the lee of the trailing branches or making use of it elsewhere.

Figure 9: A small debris dam is not causing an immediate problem but may require some subtle adjustment.

As the carrier flows alongside the next field downstream, the diversity of flow and bed morphology is improved. More distinct pools, riffles and glides are present (Figure 10). Diversity of light conditions could be improved as the LB remains heavily wooded whilst the RB is more heavily grazed and lacking in marginal habitat and bankside cover (Figure 11).

Figure 10: A greater diversity in bed depth and flow is visible downstream of the debris dam

Figure 11: The RB is heavily grazed, creating a monoculture of grass

As the carrier flows towards Great Perry Coppice, the contrast between the two banks becomes stark as the LB becomes steadily more overgrown and the heavily-grazed RB is near-vertical with very little marginal habitat. The LB through the bottom third of the carrier is so overgrown that the channel is over-shaded and in some places inaccessible (Figure 12). The balance of light and shade over a chalk stream is an important factor in the performance of the ecosystem. Shade plays a vital role in regulating water temperature and

consequently the concentration of dissolved oxygen. Salmonids can be particularly sensitive to fluctuations in temperature and dissolved O_2. However, chalk streams, being predominantly groundwater-fed, normally maintain relatively stable water temperatures compared to most other rivers. In addition, the abundance and diversity of aquatic and water-loving plants associated with chalk streams are heavily dependent on sunlight. Present research recommends an approximate ratio of 50:50 direct sunlight to dappled shade for most rivers. For chalk streams the recommended ratio is 70:30 Light over shade.

Figure 12: In places the channel is completely overgrown and inaccessible

The reach would benefit from a programme of tree works and some selective clearance to let more light into the channel. This would help promote the growth of beneficial aquatic plants such as water crowfoot as well as helping to facilitate angling. However, care should be taken to ensure that an appropriate quantity of woody habitat features are retained. For example, where large trees such as the willow in Figure 13 sprawl across the channel, large submerged limbs and root balls should be retained where possible to encourage scour and provide cover for fish. Smaller branches and higher limbs could be removed to improve light penetration and angler access.

Figure 13: Large overgrown limbs can be cut back to facilitate angling and increase light levels. However, retaining as many large submerged limbs will help maintain flow diversity.

Near where the carrier confluences with the main River Frome, a partially fallen willow has forced the stream to carve out a deep pool (Figure 14). Gravel scoured out from the pool has created a shallow glide downstream (Figure 15). This could be an excellent spawning site for wild brown trout and illustrates how woody habitat features help to enhance habitat.

Figure 14: An overgrown willow blocks the channel

Figure 15: A well-sorted gravel glide is a potentially good spawning site

The section of the main carrier visited flows through a wetland meadow not used for agriculture. The wide margin of wetland species and the rough semi-inundated grassland beyond provide excellent habitat for invertebrate species that have an in-river life-stage. Depth variation within the channel is relatively good but the river would benefit from increased diversity of flow direction and speed. There was also a considerable lack of tree cover (Figure 16). Fortunately, an abundance of small goat willows (*Salix caprea*) within the flood plain (Figure 17) give rise to the opportunity to introduce some low-growing tree cover into the margins.

Figure 16: The main carrier is lacking in bankside tree cover

Figure 17: Straight limbs cut from goat willows within the floodplain could be used to plant new trees

Goat willows are low-growing and provide excellent low cover for fish with minimum maintenance implications. Short sections of live willow can be cut from the existing trees and driven into the bank. If undertaken during winter months when the willow is dormant, it should have a very good chance of taking root and growing into new trees.

Conclusions:

The small carrier can be divided into three separate sections with different physical characteristics. The upstream-most reach is lacking in shade, bankside cover and woody habitat features. The middle reach has an abundance of bankside cover on the LB and some occasional woody habitat features. However, the RB is heavily grazed and both banks are almost devoid of marginal aquatic plants. The lower reach is overgrown by bankside trees and is heavily over-shaded.

All three reaches have overly uniform flows and the gravel bed is poorly sorted as a result (Figure 18). The introduction of some carefully positioned and secured woody habitat features would greatly improve salmonid habitat.

Figure 18: Poorly-sorted gravel compacted with fine sediment, limiting the quality of spawning habitat.

The small carrier is also lacking water crowfoot (*Ranunculus* spp). This species is a particularly important component of the chalk stream ecosystem. Following the extremely wet winter of 2013/14 many streams are experiencing diminished *Ranunculus* growth. However, over-shading and sluggish flow are almost certainly major factors contributing to its absence.

The main carrier is lacking in bankside cover and could also benefit from some marginal woody habitat to diversify flow and provide more cover habitat for adult fish.

Recommendations:

In order for the carriers of the River Frome visited to achieve their full potential as good quality habitats, capable of supporting healthy, self-sustaining populations of wild brown trout, the following actions are recommended:

1. Engage with the land owner/tenant farmer to discuss the possibility of fencing the upper bank to protect it from grazing livestock. Ideally, fencing should include occasional gates to allow grazing in the margin once or twice a year. This will help prevent a mono-culture from developing and maintain bankside biodiversity.

2. Initiate tree works to open up the lower reach of the small carrier to allow more light into the channel and facilitate angling. Once the channel is more open and accessible, initiate a programme of continued tree works on a 5-10 year rotation to maintain a broader range of canopy heights and densities. This will provide a greater diversity of light conditions over the river and also give rise to woody material that can be used to enhance in-stream habitat.

3. Make use of site-won limbs and brushwood to introduce a variety of woody habitat structures to deflect flows and introduce scour, as well as creating some low-level marginal berms to introduce additional marginal habitat and increase in-stream sinuosity (see examples Figures 19 to 22).

Figure 19: An example of a simple log deflector positioned approximately 45 degrees upstream and secured to the bed with sweet chestnut stakes and galvanised fencing wire.

Figure 20: An example of a low-level brushwood berm installed to introduce greater sinuosity and provide marginal habitat

Figure 21: An example of a pair of opposing log deflectors both pointing approximately 45 degrees upstream to enhance scour through the centre of the channel.

Figure 22: An example of 'hinging' (partially cutting and folding over) living bankside limbs to create some marginal cover refuge habitat and enhance flow diversity.

Structures should be positioned to emphasise existing natural processes. Installing brushwood structures on the inside of bends in the river will increase deposition within the structure and scour around it. Log deflectors on the outside of bends will accelerate flows as well as create good lies for trout. Both structures can be used to increase flow diversity and sinuosity through straightened sections. The WTT's Wild Trout Survival Guide (available to order

from the WTT website) and the Chalkstream Habitat Manual (available to order or to download for free) contain further information and advice for the installation of such structures. (http://www.wildtrout.org/content/wtt-publications). Watching some of the 'How to' videos on the WTT website will also help with planning a project (http://www.wildtrout.org/content/how-videos).

4. Consider trans-locating some water crowfoot into the small carrier from nearby on the Frome. One technique that has been successful on chalk streams is to use 'snowshoes'. This technique involves bending flexible stems of hazel into snowshoe-shaped structures, winding crowns of crowfoot into them and securing them to the bed (Figures23 and 24).

Figure 23: 'Snowshoes' ready to be interwoven with water crowfoot

Figure 24: A snowshoe loaded with water crowfoot is fixed to the bed of a chalk stream

5. Consider the option of reducing gradient of the bank and introducing greater sinuosity by re-grading the banks in a fe locations with a 360 excavator. A relatively small excavator (such as an 8 Tonne machine) should be sufficient and may be a quick and cost effective option.

6. Cut some live willow 'whips' from the small goat willows in the floodplain of the main carrier and drive them into the banks in 5-10 different locations along the section of the main carrier visited in order to introduce some bankside cover.

7. Also make use of live willow to create some submerged live willow habitat to provide additional refuge habitat. These features will help shelter fish during high flows as well as providing good refuge from predators such as piscivorous birds (Figure 22).

Figure 25: A live willow limb fixed into the margins of the Hampshire Avon

Making It Happen

The creation of any structures within most rivers or within 8m of the channel boundary (which may be the top of the flood-plain in some cases) normally require formal Flood Defence Consent (FDC) from the Environment Agency. This enables the EA to assess possible flood risk, and also any possible ecological impacts. Contacting the EA early and informally discussing any proposed works is recommended as a means of efficiently processing an application.

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

http://www.wildtrout.org/content/index

The Wild Trout Trust has also produced a 70 minute DVD called 'Rivers: Working for Wild Trout' which graphically illustrates the challenges of managing river habitat for wild trout, with examples of good and poor habitat and practical demonstrations of habitat improvement. Additional sections of film cover key topics in greater depth, such as woody debris, enhancing fish stocks and managing invasive species.

The DVD is available to buy for £10.00 from our website shop http://www.wildtrout.org/product/rivers-working-wild-trout-dvd-0 or by calling the WTT office on 02392 570985.

There is also the possibility that the WTT could help via a Practical Visit (PV). PV's typically comprise a 1-3 day visit where WTT Conservation Officers will complete a demonstration plot on the site to be restored.

This enables recipients 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 WTT attendees.

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.

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.