River Brue, Bruton, Somerset

An Advisory Visit by the Wild Trout Trust May 2015

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Introduction

This report is the output of a Wild Trout Trust visit undertaken the River Brue at Bruton, Somerset. National Grid Reference (NGR) ST 68445 34835. A walk-over of the site was requested by Mr Gordon Fry, a local resident and business owner. The visit was primarily focussed on identifying cost-effective and environmentally friendly solutions to maintain a naturally free-flowing channel near Church Bridge in the centre of the town.

Comments in this report are based on observations on the day of the site visit. 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.

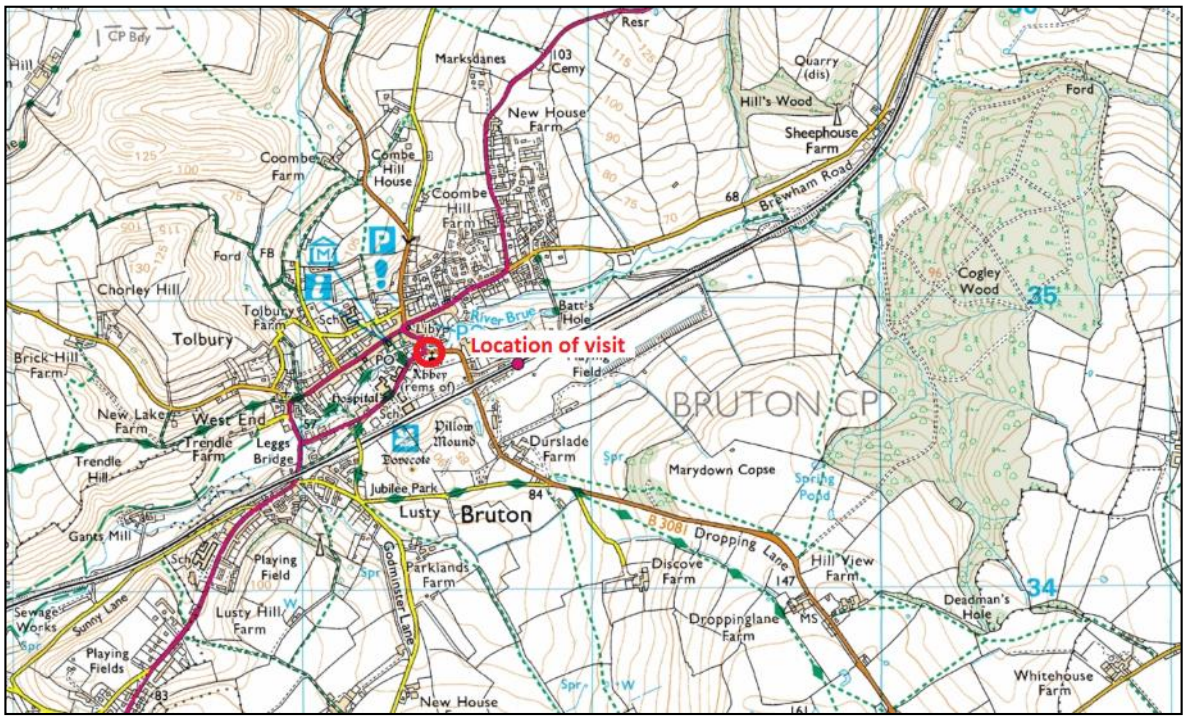

Figure 1: Map showing the location of the water visited

Catchment and Fishery Overview

The River Brue rises in the parish of Brewham in Somerset, on the western edge of Cranborne Chase and the West Wiltshire Downs. The source is near to the sources of the Dorset Stour and River Wylye, which flow southwards and south-easterly respectively. The Stour and Wylye flow over significantly different geology to the Brue and each have resultantly different physical characteristics. For example, the chalk and greensand aquifer flows of the Wylye result in relatively stable and mostly crystal clear flows. The Brue, in comparison, flows over a mixed mudstone and limestone geology, overlain with clay soils. The catchment is generally steeper than that of the rivers to the east and less permeable. This produces flows that can rise and fall over a relatively short period depending on weather conditions. The reactiveness of the catchment not only means the Brue can be subjected to particularly high flows during prolonged wet weather, but is equally vulnerable to low flow during dry summer months.

From Brewham the Brue flows south-west towards the small town of Bruton. Approximately 2km upstream of the town, the river flows through the Bruton Flood Storage Reservoir. The reservoir is designed to be empty during normal flows and only fill when flows exceed the discharge capacity of the controlling culvert. From Bruton, the river continues south west to Lydford, collecting additional flow as it is joined by Combe Brook, the River Pitt and the River Alham. The river then turns northwest and flows between the towns of Glastonbury and Street. Here, the river enters the Somerset Levels and its character changes significantly, becoming heavily modified. The Levels sections of the Brue are significantly straightened and deepened and as a result, the river habitat becomes extremely uniform. The very low gradient of the Levels creates flows that are more suited to lowland fish species such as bream (*Abramis brama*), rather than brown trout (*Salmo trutta*).

The majority of angling on the River Brue occurs in the lower reaches and this is predominantly coarse fishing. However, despite the absence of many fly fishing clubs or syndicates on the Upper Brue, wild trout are in abundance and offer good sport for fly anglers. The lack of organised trout fishing on the Upper Brue may be a double-edged sword as although the trout populations are largely undisturbed, they are also relatively unmonitored and vulnerable to pollution events and habitat problems that might be more quickly noticed and addressed on regularly fished rivers.

Under the European Water Framework Directive (WFD), the Upper Brue (Waterbody ID: GB108052021140) is classified as being in *Good Ecological Status*. This status is based on a number of parameters including water quality and populations of fish and freshwater invertebrates. However, below Bruton, the river is classified as being in *Moderate Ecological Status* (which is a failure under WFD), owing to high levels of phosphates. On the Somerset Levels, the river is designated as *Heavily Modified* and as a result can only be classified in terms of ecological *potential*. Here, the main driver for failure remains acutely high levels of dissolved phosphates.

Table 1: WFD information for the Upper Brue (Environment Agency website)

Site details	
Waterbody Name	BRUE
Waterbody ID	GB108052021140
Management Catchment	South and West Somerset
River Basin District	South West
Current Ecological Quality	Good Status
Biological Quality:	
OVERALL BIOLOGICAL QUALITY	Good
Fish	Good
Macro-invertebrates	High
General Physico Chemical Quality:	
OVERALL PHYSICO CHEMICAL QUALITY	Good
Ammonia	Good
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	Good
Ammonia	Good
Copper	High
Zinc	High

Habitat Assessment

Through most of Bruton, the Brue displays a good diversity of depth and flow conditions. Occasional spate flows, even though controlled to a certain extent by the flood reservoir, are powerful enough to maintain an active channel morphology. This results in the natural sequence of riffle, pool and glide habitat favoured by wild trout and other rheophilic (flow-loving) flora and fauna. The diversity in depth ensures that fish are able to access deeper pools where they can take refuge during periods of low flow. The Upper Brue is also well shaded, which ensures that the river remains cool during hot, dry weather. Water temperature is important as cooler water contains higher concentrations of dissolved oxygen. Many upland river species such as trout and mayfly (order Ephemeroptera) are especially sensitive to low levels of dissolved oxygen, so shade is especially important in the upper reaches of streams.

Whilst shade plays an important role in regulating river temperature, it can also hinder the growth of in-stream and marginal river plants and therefore impact on biodiversity, so a balance of dappled shade and open sunlight is required for a river to be at its healthiest. The optimal ratio of light to shade is dependent upon the river's natural potential for producing aquatic vegetation, with lowland rivers requiring a more sunlight than upland rivers where weed grows in less abundance.

At Church Bridge, the channel becomes abruptly wider and is completely exposed to open sunlight. The river also becomes impounded (held up) by the weir immediately downstream of the bridge. Both the widening of the channel and the impounding effect of the weir causes a significant slowing of flow through this section. This creates the perfect conditions for plants that would otherwise be confined to the margins of the river to encroach into the channel. To exacerbate the issue further, the weir has trapped bed material and nutrients upstream causing the bed to rise and become uniformly shallow, and ideal growing media for emergent vegetation (Figure 2).

Given enough sunlight and protection from grazing, marginal vegetation will generally encroach into a channel as far as flow velocity and depth allow. In many cases, this is a beneficial process that effectively helps rivers to adjust to lower flow conditions. The channel essentially self-narrows until an equilibrium is achieved between the vegetation and flow speed. However, if a channel is

uniformly wide and shallow, low flows can be so diffuse that this equilibrium is not readily achieved and the channel can become choked.

Figure 2: A view upstream from the bridge shows marginal vegetation beginning to encroach on the channel. This can reportedly become a major problem during the late summer (Gordon Fry, pers. comm.)

Whilst the width of the channel and lack of shade upstream of the bridge are significant factors in the rate of vegetation encroachment, the most significant factor by far is the presence of the weir. Weirs not only reduce channel morphology and habitat diversity upstream but also impact habitat downstream by interrupting natural sediment transport (becoming silt traps) and acting as barriers to fish passage (Figure 3).

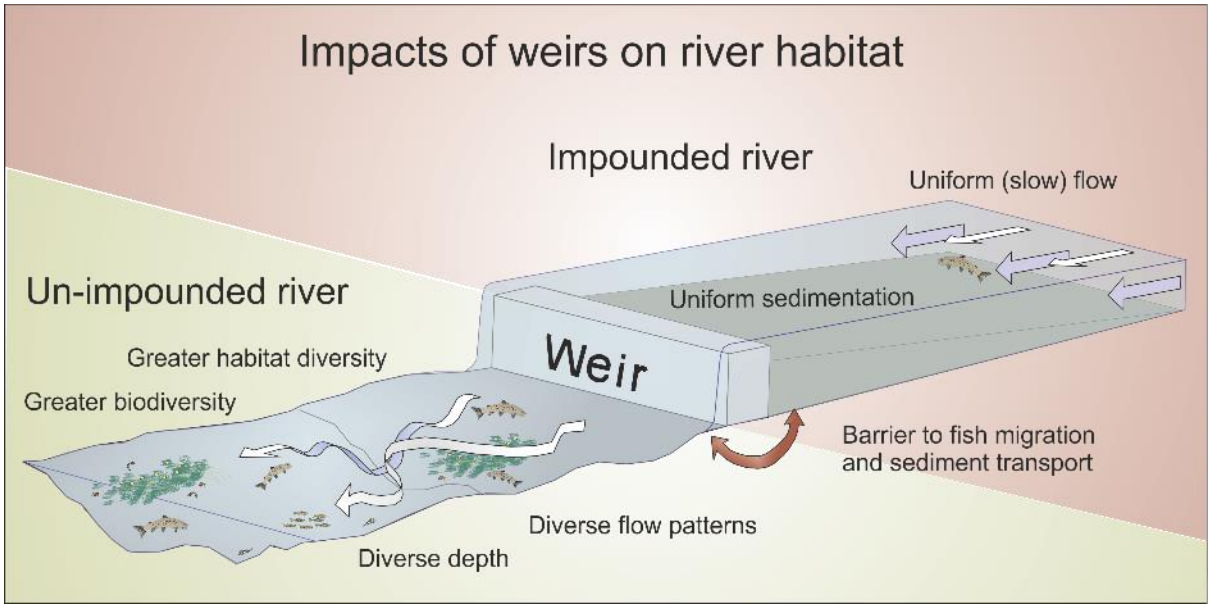

Figure 3: A healthy and biodiverse river contains a broad range of different physical conditions and features. Conversely, impounded rivers provide uniform habitat, unable to support the natural diversity of river plant and animal species. Impounded sections of a river also act as sediment traps and accumulate both coarse (gravel, cobbles etc.) and fine (silt) sediment. Perhaps most importantly, weirs act as barriers to fish passage, disconnecting fish populations and leaving them vulnerable to pollution and low-flow events, after which they cannot recolonise the impacted reach.

The weir is itself reportedly in a state of disrepair (Figure 4) and plans have been discussed locally to repair the weir as well as re-profile the channel upstream (Gordon Fry, pers. comm). The plans involve lowering the bed in the centre of the channel and using the arising material to create more defined marginal berms at the edges of the channel (Figure 5), a technique often referred to as 'dig and dump'.

Figure 4: A view downstream of the bridge, showing the weir

Figure 5: Mr Fry's concept for deepening the centre of the channel and creating more defined marginal berms either side

Whilst the basic concept of creating a two-stage channel with a more defined deeper trench or 'thalweg' through the centre is be a good solution in principle, the fact that the reach is impounded by the weir means that the deeper part of the channel would steadily refill with sediment. This would probably happen relatively quickly with fine sediment at first, gradually being replaced by larger material over time.

Ideally, the weir should be completely removed in order to restore natural morphological functionality to the reach. This would probably result in the channel naturally adjusting in such a way that the problem above the bridge would be greatly reduced. However, it is possible that the weir was originally installed to protect the footings of the bridge and further investigation may be required to ascertain the feasibility of this option.

As a next-best alternative to complete removal, a central section of the weir could instead be significantly lowered, ideally to bed level for at least a third of the channel width. This would reduce the impounding effect of the structure and draw flow through the central archway of the bridge, helping to focus scour on the bed through the centre of the channel. There is a good chance that this action alone would maintain a self-scouring profile that would keep the centre of the channel deeper and faster-flowing. This option would not remove the impoundment

entirely and, if undertaken correctly, should ensure that the bridge footings remain adequately protected. It would also significantly improve fish passage.

The 'dig and dump' operation upstream, as proposed by Mr. Fry, may prove to be unnecessary. However, re-profiling of the channel immediately upstream of the bridge, whether naturally occurring or mechanically undertaken, would not only improve flood conveyance by limiting marginal plant encroachment, but would also improve habitat quality and connectivity. A two-stage channel (Figure 6) would retain depth and flow during periods of dry weather that at present cause the reach to be uniformly very shallow, slow flowing and facilitating the encroachment of emergent vegetation.

Any 'dig and dump' bed re-profile operations would need to be undertaken with the utmost care. Excavating the bed to too great a depth will result in the pool filling in with fine sediment. The excavated low-flow channel should be roughly V-shaped in cross section so that the river is able to self-narrow and retain a good depth and flow speed during periods of prolonged dry weather.

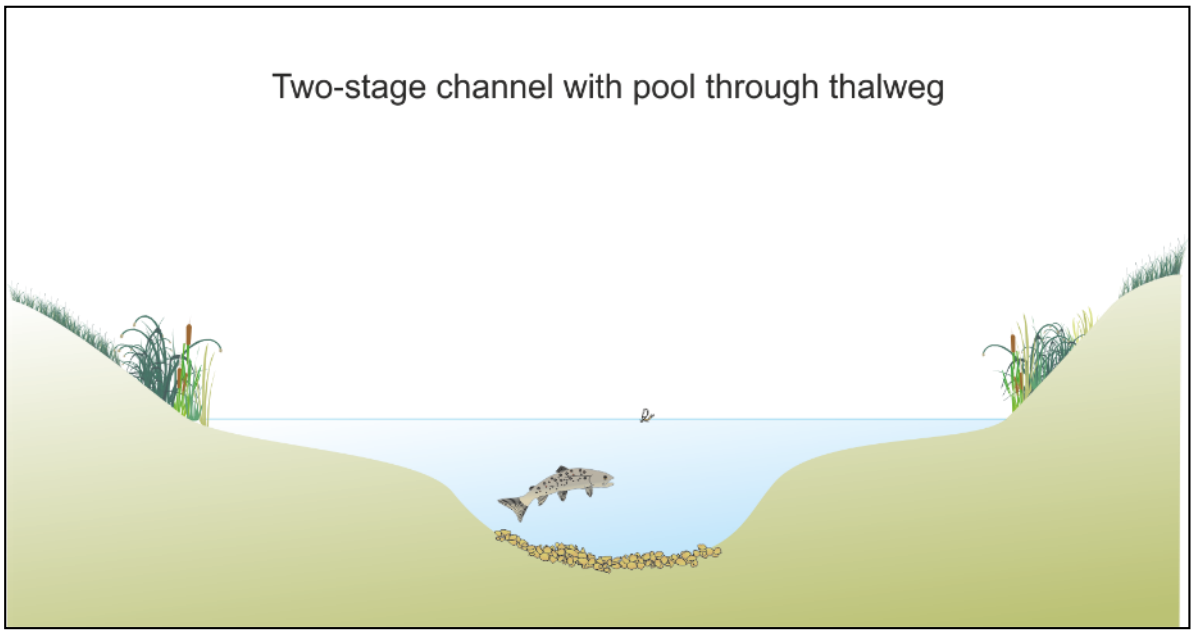

Figure 6: A basic illustration of a two-stage channel

If allowed to naturally re-grade, the channel should find a new equilibrium with the rivers annual flow. However, should a dig and dump operation go head, the width of the deepened section should be determined by measurements of sections of more-natural river upstream and downstream. This would provide a good guide

as to what dimensions the new two-stage channel should have. The berms created from the arising material should slope up from the deeper thalweg so that a certain amount of encroachment still occurs during summer months. This will ensure that the channel naturally adjusts to flow conditions without becoming choked.

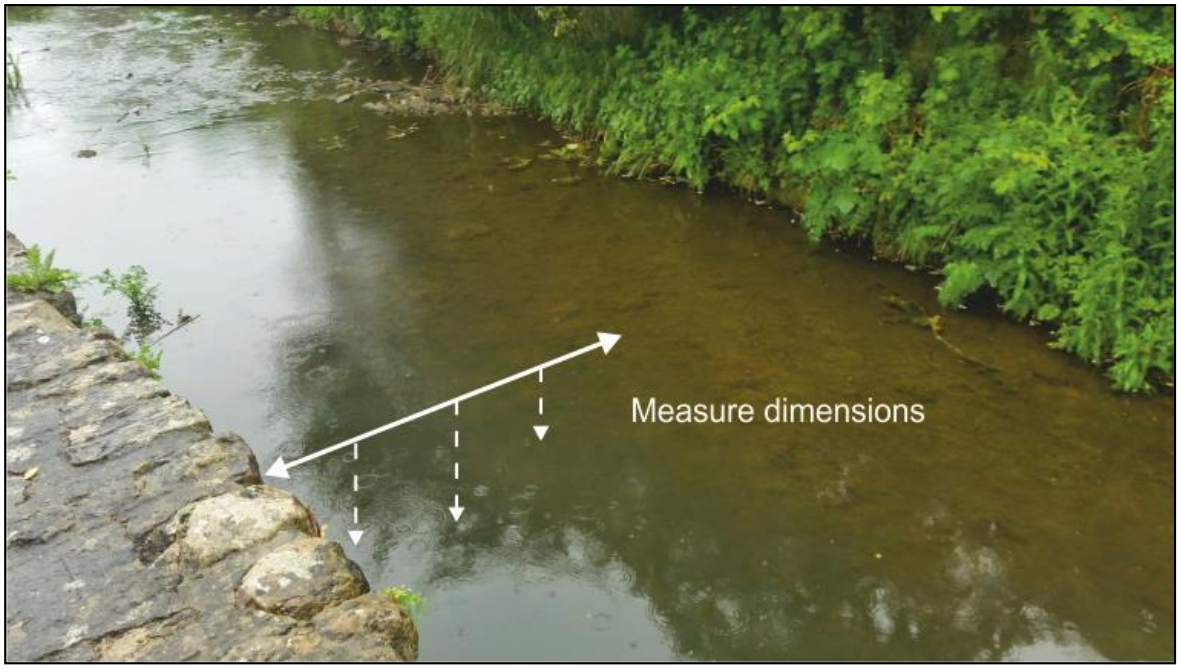

Figure 7: The channel immediately upstream of the widened section provides a good indicator of appropriate dimensions for the channel re-profile

Consolidation of the marginal berms could be accelerated by defining the edge of each berm with hazel brushwood faggots secured to the bed with long wooden (ideally untreated sweet-chestnut) fencing stakes. The berms would then be back-filled with material arising from the deepening of the central channel. This option would help to stabilise the new berms and the brushwood would quickly accumulate fine sediment and become vegetated. The rapid establishment of marginal plants will be crucial to ensuring that the excavated material is not washed downstream or back into the centre of the channel during the first spate flows. Giving the berms a defined edge will also help to ensure that any future encroachment is minimal.

Any in-channel works should be undertaken in the summer whilst flows are low. This also ensures that works are undertaken outside of the salmonid spawning season.

Recommendations:

In order for the section of River Brue visited to achieve its potential as a part of a connected and healthy ecosystem, and to function naturally with as minimal a requirement for channel maintenance as possible, the following actions are recommended:

1. Engage with the local community, council and Environment Agency and discuss the feasibility of removing the weir. The Environment Agency area Geomorphologist John Philips would be a good point of contact (john.phillips@environment-agency.gov.uk 01278 484676).

2. If removal of the weir is not a feasible option, a significant central section of the weir should be lowered to bed level. The advice of a structural engineer should be sought in order to ensure that the retained sections of the weir remain stable.

3. Once the weir has been removed or altered, the bed should be allowed a period of natural adjustment to redistribute bed materials. One winters flow should be sufficient for the channel to adjust to the new flow regime.

4. Should further re-profiling of the bank be required, the dimensions of the section of channel shown in Figure 7 should be measured along with a selection of other parts of the channel nearby that present a natural two-stage channel shape. These measurements should inform the dimensions of the re-profiled berms and channel.

   The following methodology is suggested for a 'dig and dump' bank re-profile:

   - Carefully remove the marginal vegetation on the existing berms and stockpile nearby.
   - Re-profile the bed (to the dimensions ascertained in by Recommendation 3) and spread the arising material over the existing berms. If feasible, define the edge of the berms with hazel faggots secured firmly to the bed with fencing stakes and galvanised fencing wire.

- Replace the stockpiled marginal turfs back onto the berms, especially at the front edge.

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. The headwaters of many rivers are not designated as 'Main River', in which case the body responsible for issuing consent will be the Local Authority. In any case, contacting the EA early and informally discussing any proposed works as a 'pre-application enquiry' is recommended as a means of efficiently processing an application.

In addition, before any works commence, a services check should be carried out to ensure that nothing is driven into the bed in proximity to buried services such as gas, electricity or water mains. This is in the interest of services' providers and many companies provide this information free of charge, with some providing special 'dial before you dig' hotlines.

There are a number of specialist river contractors that have a wealth of experience in delivering environmentally sensitive river engineering projects. The Wild Trout Trust can help find reputable contractors in your area.

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.

Acknowledgement

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