



Water Framework Directive Advisory Visit

River Frome, Gloucestershire

December 2012



1.0 Introduction

This report is the output of site visits undertaken by Tim Jacklin of the Wild Trout Trust to the River Frome, Gloucestershire during December 2012 and February 2013. Comments in this report are based on observations during the site visits and discussions with Rhianna Drury, Sam Chapman, Chris Bell and Cathy Beeching of the Environment Agency.

Normal convention is applied throughout the report with respect to bank identification, i.e. the banks are designated left hand bank (LHB) or right hand bank (RHB) whilst looking downstream.

2.0 Catchment Overview

The Frome rises from springs on the western side of the Cotswolds near Caudle Green and flows south to Sapperton, then west through Stroud, Stonehouse (M5 crossing near junction 13) and into the tidal Severn at Upper Framilode. From Sapperton downstream, the river runs alongside the disused Stroudwater Navigation/Thames & Severn canal, built in the C18th and abandoned in 1954. The canal is the subject of a large restoration project (www.cotswoldcanals.com/pages/a-quick-guide).

There are nine Water Framework Directive (WFD) waterbodies within the catchment. The River Frome itself comprises two (Slad Brook to River Severn and source to Slad Brook confluence) and its tributaries a further five: Painswick Stream (GB109054032460); Slad Brook (GB109054032440); Nailsworth and Horsley Streams (GB109054026530, GB109054026520 and GB109054026510). Two artificial waterbodies, Stroudwater Navigation and a section of the Thames and Severn Canal, complete the picture.

Table 1 summarises the WFD parameters relating to the River Frome and Stroudwater Navigation waterbodies. Both waterbodies on the main Frome are 'moderate' status because of the biological elements fish and invertebrates; on the downstream waterbody the moderate status for fish is because of barriers to fish migration, on the upstream waterbody the cause is uncertain. The Painswick Stream and Slad Brook tributaries are also moderate for fish for unknown reasons.

Table 1 Water Framework Directive Information (from Environment Agency website).

Waterbody Name	R Frome - Slad Bk to R Severn	R Frome - source to conf Slad Bk	Stroudwater Navigation, Pike Lock to Wallbridge
Waterbody ID	GB209054032450	GB109054032470	GB70910525
Management Catchment	Severn Vale	Severn Vale	N_A
River Basin District	Severn	Severn	Severn
Typology Description	Not Typed	Low, Small, Calcareous	Canal
Hydromorphological Status	Not Designated A/HMWB	Not Designated A/HMWB	Artificial
Current Ecological Quality	Moderate Status	Moderate Status	Good Potential
Current Chemical Quality	Good	Does Not Require Assessment	Does Not Require Assessment
2015 Predicted Ecological Quality	Moderate Status	Moderate Status	Good Potential
2015 Predicted Chemical Quality	Good	Does Not Require Assessment	Does Not Require Assessment
Overall Risk	At Risk	Probably At Risk	Not Assessed
Protected Area	Yes	Yes	No
Number of Measures Listed (waterbody level only)	17	-	-

The Environment Agency is conducting walkover surveys on the catchment to determine priorities for improving fish passage. The Wild Trout Trust's input is to assess the quality of in-stream habitat, particularly gravel spawning habitat, to inform the prioritisation, i.e. where access improvements will provide the most benefit.

At some locations gravel was sampled by pushing a perforated tin into the substrate to obtain a core sample, and then sieved through mesh sizes of 13.2mm, 2.0mm and 0.5mm. Although a rather crude method (compared with freeze core sampling) it gave an idea of the size distribution of particles, including fines between 0.5mm and 2.0mm which in large quantities can be deleterious to salmonid egg survival by filling spaces in the larger gravel matrix. Fines smaller than 0.5mm were not effectively sampled by this method but were visually assessed at each site.

3.0 Habitat Assessment

National Grid Reference (NGR): SO 78299 05716

Location: Millend Lane, Churchend. Road bridge alongside primary school, on northern channel of River Frome.

A gravel sample was taken from immediately downstream of the road bridge at this location, to the left of centre channel. The gravel was clean and well-sorted (probably as a result of localised scour caused by the bridge) and suitable for salmonid spawning. There was a small component of fines (<2.0mm) and that present was coarse sand, with very little fine sand or silt (Photos 1, 2).

Elsewhere in the vicinity, the bed substrate was similar but less well-sorted, probably because of the uniform nature of the channel. It is still usable as salmonid spawning substrate, but would benefit from some in-stream structure to cause localised scour.

Riparian habitat was reasonably good, with fencing alongside a grazed field on the left bank and overhanging trees, roots and scrub on the right bank. Some water crowfoot (*Ranunculus* sp.) was present in the more open section upstream of the bridge (Photo 3).



Photo 1 Gravel sample showing fines (<2.0mm) component (left) and larger gravel (right).



Photo 2 Area of gravel sampling downstream of bridge



Photo 3 Upstream of road bridge

NGR SO 78115 05398

Location: Millend, road bridge in front of large mill undergoing renovation into flats, on the southern channel of River Frome.



Photo 4



Photo 5

The river here emerges in two channels from under the bridge, confluent downstream of a vegetated sediment bar (Photo 5). Gravel was sampled from the point indicated on Photo 5 (red arrow). The substrate was similar in composition to the previous site (Photo 4), but a greater proportion of silt was observed during sampling. Despite this, the substrate was suitable for salmonid spawning in terms of size and being well-sorted. Beyond the immediate sampling point, substrate appeared to have a larger component (cobble and broken brick) in the faster flowing mid-channel areas.

NGR SO 80243 04499 to SO 78560 05539

Location: North channel, Downton Road bridge, Bridgend, to downstream of Bonds Mill (near Eastington Park Farm).

The river channel through this section is relatively straight apart from an S-bend under Downton Road bridge. There are some good habitat features associated with this localised sinuosity, namely a pool-riffle sequence with its associated variety of depth, flow velocities and well-sorted substrate (Photo 6). The bank height on the inside of the bends is low, providing good lateral connectivity to the floodplain and hence marginal refuge areas for fish during high water.

The remainder of the channel is straight (probably man-made) and as a result lacks depth variation. There is however good riparian habitat in the form of 'shaggy' marginal vegetation and mature trees, mostly alder (Photos 7 – 10), protected from grazing by fencing on both banks. The substrate is gravel and water crowfoot is abundant in the less shaded areas; this provides some variety of flow velocity and a degree of substrate sorting. Gravel sorting could be improved by the introduction of large woody debris structures. In general, the habitat appears favourable for salmonids and it would be surprising if this section did not support a wild trout population.

An old sluice structure is present on the left bank, with the remains of a channel leading away from it across the field (Photos 7, 8). Just upstream of the railway, extensive civil engineering works were taking place to lay a pipeline. This appeared to be taking place with due regard to the river, with minor impact at a machinery crossing point.

Downstream of the railway the habitat is similar, but the river becomes impounded as it approaches Bonds Mill. Between the railway line and Bonds Mill it is clear this reach of river is in a perched channel above the level of the land on the left (south) bank. The remains of a former channel (with bridge) can be seen in the field here and this appears to be a route for floodwater (Photo 11).

At Bonds Mill, the river is split into two channels, one flowing over a weir at the head of a culvert under the mill site (Photo 12), the other over an overspill weir on the left bank and south of the mill site (Photo 13). The channel to the south of the mill has a gravel substrate suitable for salmonid spawning in many areas; the installation of small log flow deflectors would assist in sorting this and improving spawning habitat (Photo 14). The channels re-join about 200m downstream of the mill, then the habitat is similar to that described upstream of the railway line, with similar opportunities for introducing woody debris.

Near Eastington Park Farm the river is split again by a small weir (SO 78338 05559) which was drowned out at the time of the visit, but diverting water from the main channel into a small channel on the left (south) bank (Photo 15).



Photo 6 Looking downstream from Downton Rd. (north channel)



Photo 7 Former sluice, now livestock drinking area (SO 79853 04863)



Photo 8 Former channel associated with above sluice



Photo 9 North channel near railway, downstream view



Photo 10 North channel (railway embankment visible in background), downstream view



Photo 11 Low-lying field on true left (south) bank downstream of railway.



Photo 12 Weir at head of the culvert under Bonds Mill



Photo 13 Weir into south channel adjacent to structure in Photo 12. Note gravel bed substrate.



Photo 14 Channel to south of Bonds Mill



Photo 15 Site of weir splitting flow near Eastington Park.

NGR SO 80060 04438 to SO 78109 05382

Location: South channel, downstream of Downton Road to Millend.

Running parallel to the north channel described above, this channel appears to be much more natural and could be, at least partly, the original river course. It is sinuous, has a pool-riffle sequence and good quality in-stream habitat throughout. Deep lateral scour pools associated with riparian tree roots provide excellent cover, and banks of well-sorted gravel good spawning opportunity (Photos 16, 17).

A gravel sample was taken at SO 79815 04667 which showed a good size for trout spawning, with a low proportion of fine sediment (Photo 18). This section of river should support a good fish population, although there is a barrier to fish movement (weir) at Beard's Mill just downstream of the railway (Photos 19). A small leat exits the channel upstream of the weir (Photo 20), through the Beard's Mill site (now private residences) and rejoins a short distance downstream.

Below Beard's Mill the channel is straightened for about 250m then enters a short meandering section. The latter has good in-stream habitat including woody debris (Photo 21). The discharge from Stroud Sewage works enters the channel on the left bank and from this point downstream the river is artificially straight (Photo 22). The field on the right bank is low lying with evidence of former channels, suggesting this may have been (at least partly) the route of the river prior to the split into the present north and south channels of the Frome.

At the downstream end of this reach is Millend (Photo 5) where a former mill building is being renovated into flats. There is a weir structure within the mill building itself which is another barrier to fish movement. There is a system of ditches around the site that could conceivably be converted for use as a fish bypass, although the flow capacity (hence attraction flow) would be low. A better option would probably be a fish pass on the weir within the mill building.



Photo 16



Photo 17



Photo 18



Photo 19 Weir at Beards Mill (SO7954104857)



Photo 20 Head of the mill leat channel at Beards Mill



Photo 21 Meandering section downstream of Beard's Mill



Photo 22 Downstream of sewage works discharge

NGR SO 80396 04556

Location: North channel, upstream of Downton Road, Bridgend.

The north channel here is further divided into two channels which diverge upstream of the A419 and converge just upstream of Downton Road; the more southerly is narrow, deep and incised where it runs close to houses on the right bank. The channel is generally straight and flow through this section is swift and there are few areas of slacker water (Photo 23).

At SO 80597 04531 there is a bend in the channel which has produced a lateral scour pool and a bank of sorted gravel which is good quality for salmonids spawning (Photo 24). A gravel sample was taken here (Photo 25).

The northerly arm of the north channel and the south channel were not inspected in this section.



Photo 23 Uniform, fast flowing section.



Photo 24 Lateral scour pool and gravel ramp



Photo 25 Gravel sample from SO 80597 04531

NGR SO 83254 04639

Location: Between A419 and Westward Road (B4008), Dudbridge, upstream of Ebley Mill (Council offices).

The river here is in a single channel running alongside the Stroudwater Canal. This section of canal has recently been the subject of the regeneration project (see section 2) which has included provision for improved fish passage. At this site, an overflow weir from the canal to the river has been fitted with an eel pass (left bank) and a Larinier fish pass (right bank, Photo 26). Unfortunately there appears to have been a design error relating to the baffles in the Larinier fish pass. The pass is 1.2m wide which requires two sets of Larinier baffle units (0.6m width each) side-by-side (Photo 27); the current pass contains a single baffle unit scaled up to fit the pass width. The present arrangement will not provide adequate reduction in flow velocity for effective fish passage; it should be simple to replace the baffles with pre-fabricated units (e.g. www.aquaticcontrol.co.uk).

It would be worth considering installing one-and-a-half Larinier units (which would occupy 0.9m of the channel width) and including an angled bristle mat for eels in the remaining 0.3m (Photo 28). This would improve the opportunity for eel passage by providing a pass on both sides of the channel, whilst detracting little from passage opportunities for other species.

If similar passes are planned elsewhere as part of the regeneration project, an improvement to the design would be to locate the downstream end of the pass in line with the toe of the weir (Photo 26).



Photo 26 Locating the downstream end of the pass alongside the weir face, with a suitable retaining wall (as indicated by yellow lines) greatly improves pass efficiency. This should be considered at other sites.



Photo 27 Example of a 1.2-m wide Larinier fish pass showing the two adjacent sets of 0.6-m wide baffle units (direction of water flow away from camera).



Photo 28 Example of one-and-a-half Larinier units plus angled bristle mat for eels (NB there should be a separator between the Larinier units in the position of the yellow line – as in Photo 18). Water flow towards camera.

The river at this site has generally good in-stream habitat, with a meandering planform, variety of depths, gravel substrate and some large woody debris (Photos 30 – 32). The banks are tree-lined (predominantly alder). There is a grazed field on the left bank and some bank poaching alongside the river here (Photo 31).



Photo 29 Stroudwater Canal. River is to the left (near trees); overspill weir / fish pass is in the background



Photo 30



Photo 31



Photo 32

NGR SO 86324 02845

Location: Hope Mill Lane, Far Thrupp

The river here is swiftly flowing in a single channel in a steep-sided valley. The bed substrate comprises a range of particle sizes from cobble to sand and silt and is unsorted and not good spawning habitat. In-stream structure such as large woody debris or flow deflectors would create localised scour and improve gravel quality. Habitat for juvenile and adult life-stages of salmonids is reasonably good, with plentiful marginal cover and a good depth of water (Photos 33, 34).



Photo 33 View downstream from Hope Mill Lane



Photo 34 View upstream from Hope Mill Lane

NGR SO 89678 02515

Location: A419, Chalford

The river here has a steep gradient as it descends from the Cotswolds into the Severn Vale. The channel is confined between walls and buildings which form vertical sides and maintain a narrow, uniform width. As a result of the gradient and confinement, there is little smaller than cobble-sized substrate retained on the bed here (Photo 35); this may provide some opportunity for salmon spawning, but is too large for trout. The fast flows and uniform channel make this a relatively hostile environment for fish.

Upstream of the steep-fast flowing section is a weir (and barrier to fish migration) and footbridge at approximately SO8981602515; this impounds the river for only a short distance upstream because of the channel gradient here (Photos 36, 37). Progressing further upstream, the river flows through the village, bordered by gardens, houses and the road (Photos 38-40); in-stream habitat is good here with a gravel substrate and good marginal cover.



Photo 35 Narrow, steep channel near A419 (SO8956902514)



Photo 36 Weir and footbridge in Chalford (SO8981602515)



Photo 37 Impounded section upstream of weir in Photo 27



Photo 38



Photo 39



Photo 40



Photo 41



Photo 42

NGR SO 90370 02518

Location: Upstream of Chalford, Valley Corner (junction of Marley Lane and High Street).

Just downstream of this point the river is straight and narrow and has abundant growth of water crowfoot (Photo 41); the channel is separated from the disused canal on the left bank by a footpath (Photo 42).

The river is culverted under Marley Lane and upstream the channel is wider and flows alongside a playground / public open space. Some bank reinforcement work has been carried out here by the Environment Agency (Cathy Beeching, pers.comm.). The channel shape here is uniform and the bed substrate unsorted. Installing flow deflectors or woody debris would promote localised scour and improve depth variation and bed sorting.

NGR SO90984 02768 – SO 91193 02880

Location: Alongside Oldhills Wood

The river here was inspected from two fields on the right bank. The channel is straight (alongside the canal and railway) and uniform in width and depth. The downstream limit was at a private house and garden where an old sluice structure impounded the river (Photo 43). Immediately upstream of this structure the river bed is dominated by fine sediment which has settled out (Photo 44). Marginal habitat on the right bank is good here – soft, shaggy edges - whereas the left bank is a steep embankment (alongside the adjacent canal) dominated by young trees of a similar size.

In the middle of this section is a flow gauging weir. Downstream and upstream of this, the river is fast flowing and predominantly shallow. Marginal habitat on the right bank is poorer than downstream due to grazing, and it would benefit from fencing (Photo 45). Although the bed substrate comprises gravel of a good size for trout spawning, it is poorly sorted. Two or three notable exceptions are where woody debris has created localised scour, depth variation and gravel sorting (Photos 46, 47).

Installation of flow deflectors and woody debris would greatly improve in-stream habitat along this section for a relatively low cost. A more ambitious project could involve creating a more sinuous channel using the fields on the right bank.



Photo 43



Photo 44



Photo 45



Photo 46 Scour beneath this log has created a deeper pool and ramp of clean gravel



Photo 47 Further bed scour and gravel sorting by large woody debris

NGR SO 91775 02910 – SO 92932 02985

Location: Reservoir near Bristley Hill Wood to Whitehall Bridge
(Gloucestershire Wildlife Trust reserve)

The downstream end of this section is bounded by a reservoir (Photo 48), the dam of which is an obvious barrier to fish movement. There is a short section of river upstream of the reservoir to Puck Mill Upper Lock, which has some good quality gravels suitable for spawning (Photos 49, 50). However, the gravels appear to be very clean and recently deposited, suggesting they may be the result of a recent flood event and not typical; evidence of this was seen at several sites upstream of this point. From Puck Mill Upper Lock, the river is culverted underneath the canal for approximately 150m creating another impediment to fish movement.



Photo 48



Photo 49



Photo 50



Photo 51



Photo 52



Photo 53

Alongside the property near Whitehall Lower Lock there was further evidence of recently deposited gravel as a result of high water (Photo 51). Upstream of this point, the river habitat transformed in a completely unexpected way, becoming a flat, inundated valley bottom with no discernible river channel (Photo 52); this continued for about 750m upstream to Whitehall Bridge. Beyond this point the river flows through a Gloucestershire Wildlife Trust nature reserve (Siccaridge and Sapperton Woods) and appears to have good in-stream habitat (Photo 53).

NGR SO 95134 06421

Location: Brook Grove, Edgeworth

Located on the upper reaches of the river, this section displayed more evidence of a recent, significant flood having moved the bed load of the river. Upstream of the road the river appears to have been impounded by the throttling effect of the culvert, causing fine sediment to settle out (Photo 54).

Downstream of the road, deep pools had been scoured out on bends in the channel and clean, well-sorted gravel deposited in riffles downstream (Photos 55 – 57). The in-stream habitat appeared very good as a result of this, but it raises the question of how frequently this occurs and its impact on fish spawning and invertebrates. If it is a relatively rare event, then the effect is likely to be beneficial; if it occurs frequently, washout of fish eggs and invertebrates could limit populations.

Other aspects of river habitat at this site are good, including low intensity adjacent land-use, mixed shading and channel form and level relative to the floodplain (Photo 58).



Photo 54



Photo 55 A deep scour pool on a bend and clean gravel deposits downstream. The flattened marginal vegetation indicates recent high water.



Photo 56



Photo 57 Clean, well-sorted gravel, ideal for trout spawning...as long as it stays put.



Photo 58

NGR SO 94820 08067

Location: Bull Banks

A wooded section of river in the headwaters of the Frome. Again evidence of recent significant bed load movement, with large deposits of fresh gravel in side bars. Generally good in-stream habitat (Photos 59 – 61).



Photo 59



Photo 60



Photo 61

4.0 Recommendations

The main purpose of this walkover survey was to identify suitable areas of spawning and juvenile habitat for trout and salmon, with regard to their accessibility to adult fish migrating upstream. There are a large number of barriers to fish migration and many channel modifications (and splits) throughout the Frome system and it has not been possible to visit all of them during this survey.

The sections of river between Churchend / Millend and Ryeford have good in-stream habitat and spawning conditions salmonids, particularly the south channel upstream of Beard's Mill. The north channel is more uniform (straight and lacking depth variation) but could be improved with the introduction of woody debris and flow deflectors.

The short section of river seen at Ebley also provided good in-stream habitat for salmonid spawning and juveniles. It is recommended that further

sections are inspected between here and Ryeford and also upstream to Thrupp, to see if the habitat quality extends to these areas. If so, facilitating fish passage to this reach could be worthwhile and may also provide access the Painswick Stream (see separate report) and Slad Brook.

Upstream of Chalford, the river gradient increases and whilst spawning opportunities and juvenile habitat are present in places, these areas are very fragmented and separated by numerous barriers. There are opportunities to improve conditions for non-migratory trout in some sections (e.g. upstream of Chalford).

Gravel substrate is present through almost all the sections visited. Spawning habitat quality could be improved in many areas with the use of woody debris and flow deflectors to create localised scour and mimic the effects of the natural examples described above. The Wild Trout Trust is available to provide practical demonstrations of the introduction of such structures.

5.0 Making it Happen

Progress in improving accessibility and habitat on the River Frome will depend very much on the prioritisation process and cost-benefit considerations of improving migratory fish access to the wider Frome catchment. WTT is available to assist with practical demonstrations to local stakeholders of spawning habitat improvements (e.g. with woody debris installation) and low cost easements at suitable barriers. Funding for this kind of work could be sought in 2013/14 through an application to EA Head Office under the WFD agreement that supported this walkover visit and report.

6.0 Acknowledgement

The Wild Trout Trust would like to thank the Environment Agency for the support which made this visit possible.

7.0 Disclaimer

This report is produced for guidance and not for specific advice; no liability or responsibility for any loss or damage can be accepted by the Wild Trout

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