



Prior Park Stream, Bath



A Project Proposal by the Wild Trout Trust August 2014

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Introduction

This report is the output of a Wild Trout Trust visit undertaken on Prior Park Stream, Prior Park, Bath (national grid reference (NGR) ST 7556 6408). A walk-over of the site was requested by Christopher Davies, a resident of Prior Park Buildings and was primarily focussed on assessing the river habitat for wild trout (*Salmo trutta*) and for wildlife in general.

Comments in this report are based on observations on the day of the site visit and discussions with Mr Davies and Jody Armitage of the Environment Agency. 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.

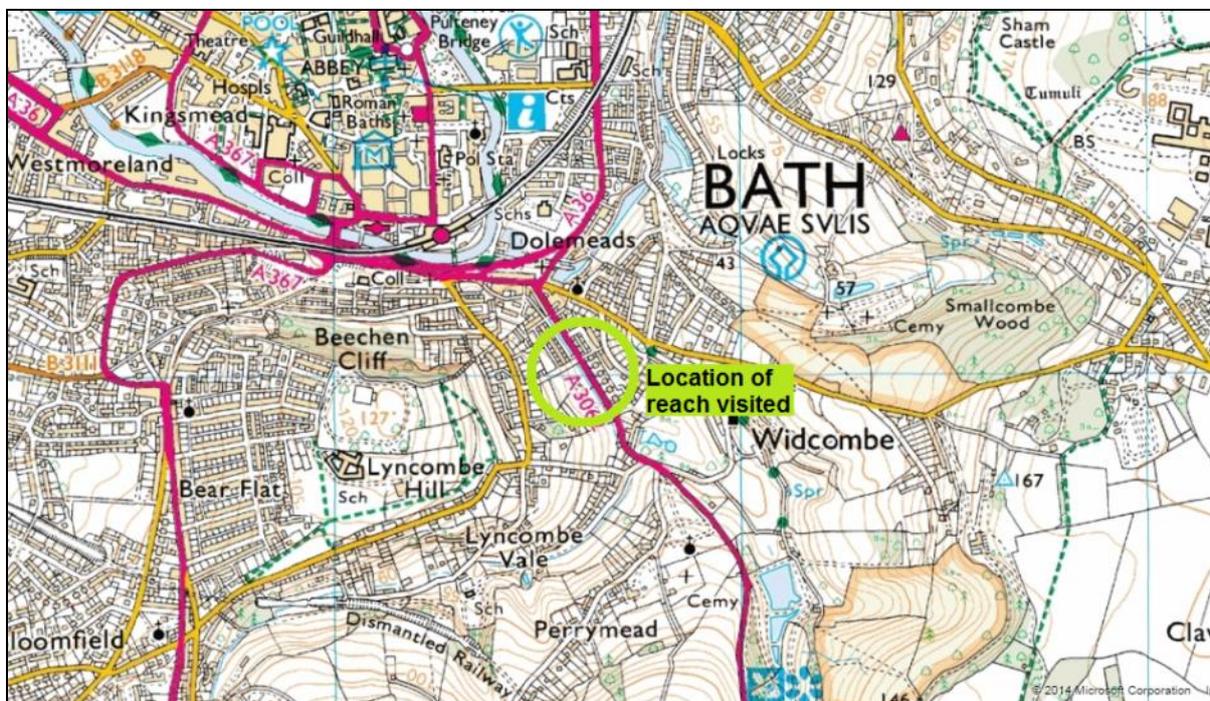


Figure 1: Map showing the location of the reach of Prior Park Stream visited

Catchment and Fishery Overview

Prior Park Stream is a small rivulet that flows from springs at Prior Park, an 18th century Palladian villa and landscape garden, to Prior Park Buildings, a Georgian terrace, where the stream enters a culvert which confluences with another culverted stream (Lynn Brook) before discharging into the Bristol Avon.

The exact course of the stream is something of an enigma, similar to other nearby streams; much of the Prior Park Stream has been culverted or otherwise heavily modified. Prior Park Stream has often been wrongly labelled as Lynn Brook, which actually flows through a culvert that runs parallel to the stream in places.

The stream rises from springs in Prior Park and is almost immediately impounded to fill ornamental fish ponds within the gardens. From the fish ponds the stream flows northwards through private residences where it is impounded to form another small pond before dropping into a culvert. Just upstream of Prior Park Garden Centre, the river re-surfaces and flows parallel to Prior Park Road to Prior Park Buildings.

The geology of the area is predominantly oolitic limestone. This has benefits for invertebrates that form their exoskeletons from dissolved calcium carbonate. Unfortunately this includes alien invasive American signal crayfish (*Pacifastacus leniusculus*) which infest the stream.

At Prior Park Buildings, the stream used to hold populations of chub (*Leuciscus cephalus*), dace (*Leuciscus leuciscus*), minnows (*Phoxinus phoxinus*) and trout. However a pollution incident in the summer of 1999 caused fish mortalities and despite local residents rescuing a number of fish, the stream has since failed to support healthy populations. The quality of the stream habitat at Prior Park Buildings has also deteriorated over recent years. This is in part due to the stream no longer being regularly cleared of fine sediment by the local council, and probably partly owing to the heavy infestation of signal crayfish. It should however be noted that the physical constraints of the heavily modified stream impact on its ability to quickly recover from such threats.

The stream is not designated 'Main River' by the Environment Agency and as a result does not have a classification under the Water Framework Directive and is not surveyed for fish, invertebrates or other biological quality indicators.

Habitat Assessment

Near the upstream boundary of the reach visited, the stream flows down from Prior Park and enters a culvert through a drain cover at Church Street, NGR: ST 75930 63736 (Figure 2). The culvert is completely impassable for upstream migration but it is possible that small and juvenile fish could drop down from the fishing lakes and pass downstream. The river re-emerges on private property immediately upstream of Prior Park Garden Centre and the exit of the culvert was not inspected during the visit.



Figure 2: The entrance to the culvert at Church Street. Whilst it is almost certainly impossible for fish to pass upstream through the culvert, it might be possible that juvenile fish can drop through it downstream.

Nearby Lynn Brook flows through Lyncombe Vale via an artificial perched channel (Figure 3). The brook enters a culvert at Bagatelle House, at the Junction of Lyncombe Vale and Ralph Allen Drive and flows underground past the garden centre and Prior Park Buildings, which may explain why there has been some confusion between the two streams. At the garden centre, there is also an offtake for excess spate flow from Prior Park Stream, diverting it into the Lynn Brook culvert.



Figure 3: Lynn Brook flows through a perched channel above Lyncombe Vale

At the upstream boundary of the garden centre the riverbank is densely populated by horsetail (*Equisetum* sp., Figure 4). Horsetail is a living fossil; the last remaining genus of the Equisetaceae family which for a hundred million years dominated the understory of the late Paleozoic forests.



Figure 4: Horsetail dominates the bank at the upstream extent of Prior Park Garden Centre

Reproducing with spores and arising from deep roots, *Equisetum* species can be invasive and difficult to control. Nonetheless some control of this plant may be required in order to maintain biodiversity.

Alongside the remaining length of the garden centre car park, the stream flows through a straightened but naturalised channel with a bed comprising sand, gravel and tufa (a granular substance formed by the precipitation of carbonate minerals). A variety of true marginal plant species are present including sedges (*Carex* sp.), meadowsweet (*Filipendula ulmaria*), willow herb (*Epilobium* sp.) and water dropwort (*Oenanthe* sp.).



Figure 5: Prior Park Stream along the garden centre car park

In places the bed is smothered with a layer of fine sediment and the stream would benefit from some in-channel structure to deflect flow and scour fine sediment from the bed.

The land between the stream and the road (the Right Bank) is neglected and obstructs the stream from view from the road. Some clearance work along this strip of land, in combination with the introduction of a few small in-stream flow deflectors would deliver habitat enhancement benefits and significant aesthetic improvements. Making the stream a prominent landscape feature of the garden centre car park would help highlight the importance of the stream within the local community and could help ensure that any future water quality or habitat problems are quickly identified and tackled.

From the garden centre, the stream flows along a perched and canalised channel in front of the Prior Park Buildings Georgian terrace. The stream is straightened,

over-wide and heavily impounded (Figure 6). The result is that flow is uniformly sluggish and laminar, allowing fine sediment to drop out of suspension and blanket the bed.



Figure 6: Prior Park Stream along the front of Prior Park Buildings

Whilst the LB is a vertical face of stone blockwork, the RB has been softened by the installation of some marginal brushwood faggot bundles. Where the introduced soft margin receives sufficient sunlight, marginal plants have flourished. However, under the shade of bankside trees, the brushwood remains un-vegetated. Shade from bankside trees help to keep rivers cool during summer months, helping maintain appropriate water temperature for fish and invertebrate species sensitive to low levels of dissolved oxygen. However, sunlight is also vital for marginal and submerged plants. The Environment Agency's *Keeping Rivers Cool* guide (available from the WTT website at:

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

recommends an approximate 50:50 ratio of dappled shade to direct sunlight.

The channel in front of the terrace can be divided into two sections upstream and downstream of a weir situated approximately halfway along the terrace. Upstream of the weir the stream is generally shallower, particularly towards the upstream extent of the terrace (Figure 7). Below the weir the channel is deeper

and further impounded by the structure at the downstream extent of the terrace where the stream drops into another culvert (Figure 8).



Figure 7: The stream upstream of the weir at Prior Park Buildings



Figure 8: The entrance to the culvert at the downstream extent of the Prior Park Buildings reach.

Many of the shrubs and plants growing on the RB are ornamental cultivars with little habitat value for the stream. Removing these shrubs and replacing them with small, native trees such as elder (*Sambucus nigra*) hawthorn (*Crataegus monogyna*) or goat willow (*Salix caprea*) would be beneficial for the ecology of the stream. Willows and hawthorn in particular are associated with a high

number of invertebrate species. Terrestrial insects occasionally fall into streams and supplement the diet of carnivorous and omnivorous fish. Fallen elder berries are also known to be food for certain fish species. Additionally, all three species are low-growing, providing good overhead cover without over-shading and all three produce flowers, making them aesthetically pleasing and good for wildlife.

Conclusions:

Prior Park Stream is a very poorly connected headwater habitat. The various culverts and weirs fragment the habitat into a series of short sections. This makes the plant and animals that inhabit the stream particularly vulnerable to environmental changes such as pollution or invasive species. Whilst the stream at Prior Park Garden Centre would benefit from some relatively minor habitat enhancements, the stream at Prior Park Buildings is heavily modified and suffering from some fundamental problems.

The physical uniformity of the habitat is a limiting factor hindering biodiversity. In simple terms, there are too few habitat niches, supporting too narrow a range of species to constitute a healthy river ecosystem. The dimensions of the channel, in combination with the impoundments, also create textbook conditions for sedimentation. The fine sediment smothering the bed further compounds the uniformity of the habitat.

In addition to the poor quality of the habitat, the infestation of signal crayfish is a serious problem affecting the ecology of the stream. Crayfish are omnivorous and will prey on other invertebrates (including other crayfish), and fish eggs and fry.

Habitat in Prior Park Stream can be improved via the undertaking of some simple habitat enhancements. However, the disconnected nature of the stream means that it is very unlikely to ever be able to support a self-sustaining population of wild trout. Even if the stream could be fully re-connected, Prior Park Buildings are near the headwaters and the stream is naturally too small to support a resident adult population. This does not mean however that the stream cannot provide a healthy ecology capable of supporting populations of smaller fish such as minnows, roach and dace.

Brown trout, being territorial apex predators with different habitat requirements at each stage of their complex lifecycle, make an excellent indicator species for river ecology. As a general rule of thumb, to make a river good for trout it must first be good for a plethora of other river species. Despite the absence of a wild trout population, habitat improvements that would normally benefit trout could nonetheless significantly improve the ecology of Prior Park Stream.

Recommendations:

In order for Prior Park Stream to achieve its full potential as a good quality river habitat capable of supporting healthy self-sustaining populations of small fish, the following actions are recommended:

1. It is understood that a trapping licence has been requested from the Environment Agency to help control the crayfish infestation. This is a sensible action but trapping may need to continue long-term even after the infestation is deemed to be under control. Crayfish are cannibalistic and large adults often play a role in controlling the numbers of smaller juveniles. Whilst trapping is a good means of removal for adult and larger juvenile crayfish, it often excludes smaller juveniles and so a sudden halt to a trapping operation could result in a sudden population boom.
2. Engage with the residents of the terrace to discuss the possibility of removing the weir half way along the terrace in order to reduce the impounding effect and improve flow speed. If fully removing the weir is deemed to be unfeasible, options to lower a small section of the weir to facilitate fish passage should be explored. At the very least, fish passage over the weir should be improved via the installation of a low-cost fish passage easement (Figure 9).

Better connecting the canalised reach at the terrace to the more-natural habitat at the garden centre could for example, facilitate minnow reproduction, possibly leading to a self-sustaining population.



Figure 9: An illustration of how a notching a section of the weir could be combined with a timber balk pre-barrage to ease fish passage.

3. Engage with other local residents and the garden centre to plan a habitat improvement project through Prior Park Buildings and Prior Park Garden Centre.
 - a. At Prior Park Garden Centre, efforts should focus on improving the diversity of wetland and marginal plant species and keeping the channel clear of fine sediment. The latter task can be achieved by the simple installation of some occasional 'pinch points' and flow deflectors to accelerate flow where sedimentation is excessive. Pinch points could be created by importing some small-sized flint or limestone gravel, perhaps stabilised with some larger cobbles. This could also provide some potential spawning habitat for minnows. Flow deflectors could be constructed from short logs approximately 100mm in diameter.
 - b. At Prior Park Buildings, non-native shrubs should be replaced with small, low-growing native trees such as elder, hawthorn and goat willow. Ideally, the large conifers should also be replaced but this

would be a major operation with considerable costs and may be better as a long-term goal. It is also recognised that the conifers may provide some privacy screening for the properties.

- c. A lack of both in-stream sinuosity and marginal habitat can be addressed by installing some coarse brushwood habitat similar to that previously installed along the RB. However, instead of laying brushwood bundles in a straight line along the bank, the opportunity should be taken to introduce sinuosity by creating a series of alternating brushwood berms along the length of the channel (Figures 10 and 11).

This would also narrow the channel and increase the flow speed, helping to mobilise fine sediment and reduce the rate of sedimentation.

Particular care should be taken to ensure that the berms are positioned under direct sunlight so that the berms can be colonised by marginal and emergent plant species.

Considering the sluggish flow, some thought should be given into which plant species are most appropriate. More aggressive colonising species such as reed sweet-grass (*Glyceria maxima*), and branched bur-reed (*Sparganium erectum*) should be avoided in favour of more easily-controlled species. Yellow flag iris (*Iris pseudacorus*), marsh marigold (*Caltha palustris*), water forget-me-not (*Myosotis scorpioides*) and purple loosestrife (*Lythrum salicaria*) would be good choices as they are very unlikely to encroach across the channel. These species also produce aesthetically pleasing, brightly-coloured flowers which would enhance the gardens of the terrace.



Figure 10: An illustration of how alternating brushwood berms could introduce marginal habitat and also increase sinuosity

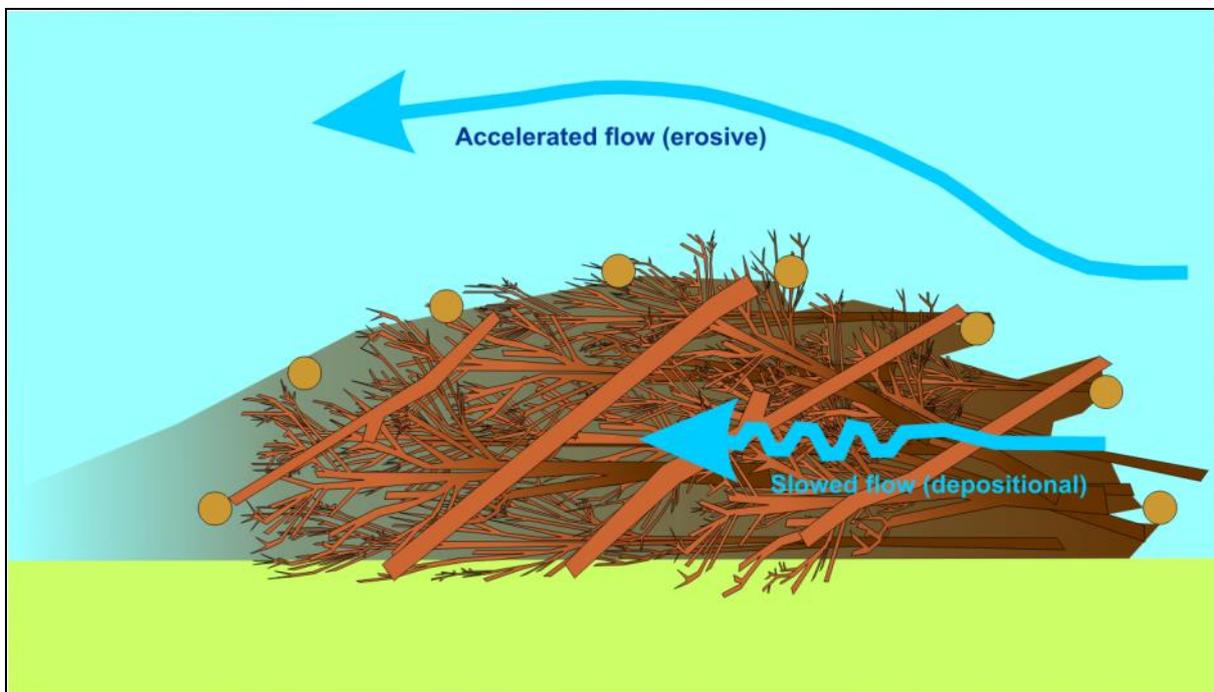


Figure 11: An illustration of how brushwood berm structures can help manage in-stream fine sediment

Making It Happen

The creation of any structures within most rivers or within 8m either side normally require formal Flood Defence Consent (FDC) from the Environment Agency. However, as Prior Park Stream is not classified as 'Main River', the

consenting authority will be Bath and North East Somerset Council. An application will have to be submitted, probably along with a methodology and drawings detailing the proposed works. This enables the EA to assess possible flood risk, and also any possible ecological impacts. Contacting the council 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.