River Wey – Bishops Meadow Trust

An Advisory visit by the Wild Trout Trust – August 2012

1. Introduction

This report is the output of a Wild Trout Trust visit undertaken on the River Wey at Bishop's Meadows, Farnham – national grid reference (NGR) SU836462. The visit was requested by Mr R K Broughton, who is a serving member of the Bishops Meadow Trust. The visit was primarily focussed on options to enhance the river Wey through the meadow for the benefit of wildlife and local people.

This section of the River Wey (North Wey Alton to Tilford) is classified as being in Moderate Ecological Condition under the Water Framework Directive and is identified in the Environment Agency's River Basin District plan as water body ID no. GB106039017830.

North Wey (Alton to Tilford)	
Waterbody ID	GB106039017830
Waterbody Name	North Wey (Alton to Tilford)
Management Catchment	Wey
River Basin District	Thames
Typology Description	Low, Medium, Siliceous
Hydromorphological Status	Not Designated A/HMWB
Current Ecological Quality	Moderate Status
Current Chemical Quality	Does Not Require Assessment
2015 Predicted Ecological Quality	Moderate Status
2015 Predicted Chemical Quality	Does Not Require Assessment
Overall Risk	At Risk
Protected Area	Yes

Number of Measures Listed (waterbody level only)	2

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

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.

2. Catchment and Fishery Overview

The Wey North forms the northern arm of the upper Wey catchment. It rises from a chalk aquifer near Alton, Hampshire and runs eastwards through Upper Froyle and Bentley to Farnham more-or-less parallel to the A31. At Farnham the river turns south towards Tilford where it joins the South Wey.

Much of the North Wey has been modified for milling, agriculture and flood defence. South of the A31 near Wrecclesham the river has been split into two channels with the flow regulated by two impoundments at NGR SU830458 and at Weydon Mill (NGR SU835461). Weydon Mill is no longer a working mill, however the impoundment now forms a fixed crest weir which fragments habitat and blocks access for migrating fish. Flow passing into the original river channel is regulated by the upstream off-take structure.

The upstream structure is in a dilapidated condition but still functions to hold the majority of the available water in the high level milling channel above. The channel below the off-take weir (following the original course of the river) is deprived of flow to the extent that marginal vegetation has overgrown and now chokes much of the stream, potentially posing a risk of reduced conveyance during the summer months. Both streams pass under the A31 via separate wide culverts. The milling channel boarders a footpath and several properties whilst the old relict natural channel meanders through open fields before re-joining at the lower end of Bishops Meadows.

Along with the extensive modifications, the river also receives substantial quantities of treated effluent from Alton and Bentley Waste Water Treatment Works. However, despite these stresses to the river habitat, the North Wey through Bishops Meadow is reported to support a healthy mixed fishery with populations of chub (*Leuciscus cephalus*), dace (*Leuciscus leuciscus*), roach (*Rutilus rutilus*), perch (*Perca fluviatilis)* and brown trout *(Salmo trutta)*. The river here is also known to support bullhead (*Cottus gobio)*, a protected species under the European Habitats Directive.

The North Wey flows over sandstone bedrock with a superficial alluvium geology consisting of clay, silt, sand and gravel. Despite not being a true chalkstream (i.e. a stream rising from *and flowing over* chalk geology), the river has many chalkstream characteristics including established communities of water crowfoot *(Ranunculus spp)* and starwort *(Callitiche spp)*.

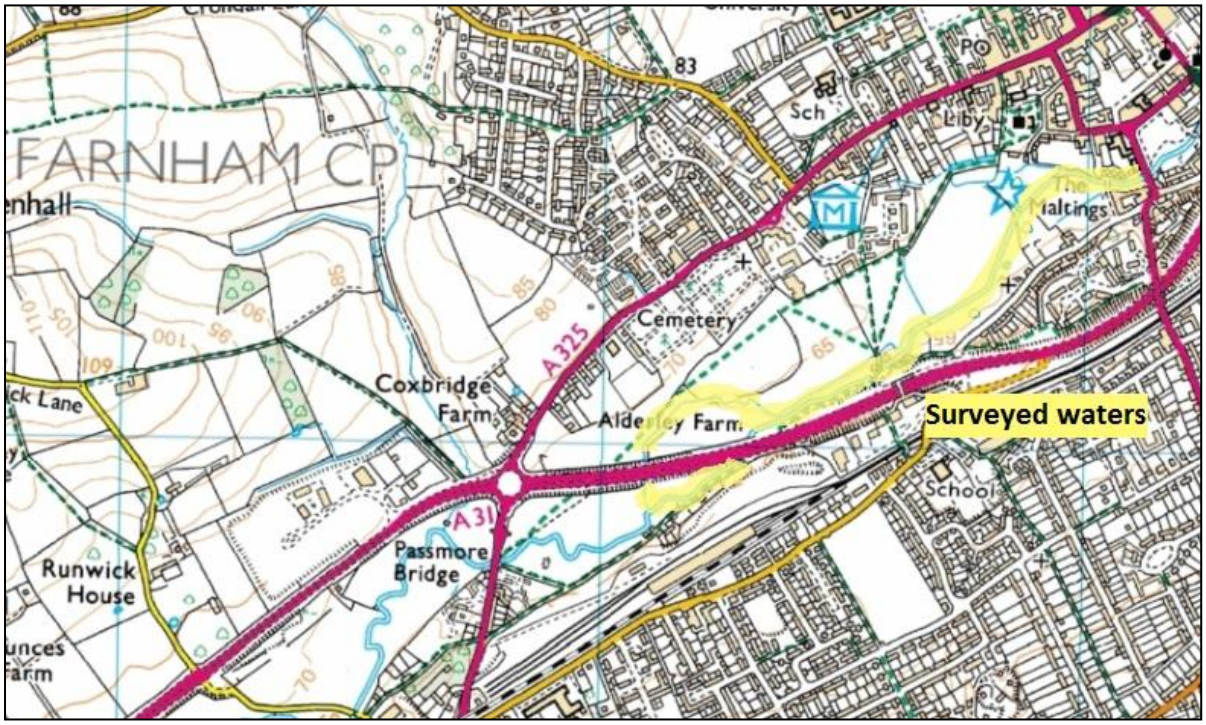

Figure 1: The river Wey North at and around Bishops Meadow

3. Habitat Assessment

The river at Bishops Meadow can be separated into three main sections:

- The high level milling channel running above and below Weydon Mill

- The narrower (natural) channel running below the take-off weir at NGR SU830458 and bisecting the fields adjacent to Aldesley Farm.
- The main river downstream of the confluence of the two channels.

3.1 The Milling channel

The milling channel flows adjacent to a number of private properties and alongside a public right of way. In places the river supports some good quality and diverse habitat features including classic pool-glide-riffle sequences, some of which is swept clean by valuable examples of large woody debris. However, much of the channel is impounded by Weydon Mill, causing the habitat to degrade as flows slow and sediment drops out of suspension to smother the bed. Sporadic clusters of marginal vegetation are established along the stream but the majority of bankside habitat has been colonised by upper-bank and terrestrial species. The stream appears to be largely unmanaged allowing willow sallows and hawthorn scrub to protrude into the channel – providing important coarse woody debris (CWD).

Figure 2: Marginal vegetation and overhanging tree cover on the top end of the milling channel

CWD is a vital component of the river ecosystem that provides habitat for invertebrates, fish, birds and mammals; controls sediment distribution, and increases variation in water depth and velocity.

The channel passes through a long box culvert under the A31 and into Bishops Meadow. Sometimes culverts can be obstacles to fish passage as some fish can be deterred from swimming through particularly dark places. Streams can also become particularly shallow through box culverts.

In this case the wide dimensions of the culvert (in relation to its length) allow a good quantity of daylight into the channel. The culvert also supports enough depth of water to accommodate effective fish passage. It is very unlikely that the culvert would pose a problem for any fish moving up and down the stream.

Figure 3: The wide box culvert under the A31

On the meadow side of the A31, both the milling and original streams are separated by a tall bund. The river appears to have once flowed along a path that meandered between the two existing channels but has since been engineered to flow in two separate straightened courses. The bund between them is most likely the dredged material left-over from these works.

Figure 4: Marginal vegetation helping to add some sinuosity to the straight channel

Along this straightened reach, the pool-glide-riffle sequences observed upstream are no longer obvious and the channel appears to be more-or-less uniform in terms of depth and width. Despite the relatively homogenous habitat, marginal vegetation growth has helped to introduce some sinuosity into the reach and overhanging plants provide some good cover for fish. As the stream approaches Weydon Mill, water is backed-up and slowed by the mill weir impoundment.
This structure is likely to be impassible to fish under most flow conditions and effectively fragments fish populations and river habitat.

It is worth noting that despite the milling channel being impounded by Weydon Mill, the river supports some good quality habitat for flow loving fish species. This is mainly due to the bed slowly re-grading over time.

Figure 5: The weir at Weydon Mill. This is a significant obstacle to fish passage

Downstream from the mill weir the stream widens out and flows along the bottom of a private garden before dropping over a smaller secondary weir to re-join the narrow natural channel. The river is particularly wide where the two streams meet but the natural encroachment of emergent and marginal plants has helped to narrow the channel and maintain elevated flow velocities.

Figure 6: The confluence of the milling and original streams. Marginal growth helping to naturally narrow the river promoting gravel cleansing water velocities.

3.2 The original channel

The natural river channel downstream of the weir at NGR SU830458 now consists of a small stream that has long been deprived of flow. The stream is over-grown with marginal and emergent vegetation to the extent that it may be backing up water during spates, especially during the summer months and could pose a potential flood risk.

This stream flows under the A31 via a culvert similar to that on the milling channel. Downstream of the culvert the naturally meandering path of the river is clearly visible from aerial photography (Google Earth etc.). The stream follows sweeping meanders that give it greater overall length and therefore a greater total area in terms of potential habitat compared to the straight milling channel. The banks are also populated by a greater volume and diversity of marginal plant species compared to the milling channel.

Figure 7: Aerial photograph showing the natural path and straightening of the original channel

Further downstream the original channel has also been straightened. Here the flood conveyance performance is significantly reduced by overgrown emergent vegetation including reed sweetgrass *(Glyceria maxima)* and watercress *(Nasturtium officinale)*.

Apart from the take-off weir at NGR SU830458, the original channel is free from artificial impoundments and obstacles to fish passage. However, the dense emergent vegetation probably restricts fish movements. Small species such as minnows and some coarse fish fry are likely to take refuge in the channel and the stream is likely to be a good habitat for amphibians. However, adult larger fish and flow-loving species are unlikely to inhabit the stream.

Figure 8: Overgrown emergent vegetation in the straightened reach of the original (now modified) channel

The slow flow rate is causing sediment to drop out of suspension and smother the bed. No suitable spawning habitat is available for trout or other gravel spawning fish species.

Trees are noticeably absent from the banks (particularly the LB) resulting in very little of the stream being shaded from direct sunlight.

Current Environment Agency advice suggests that stream habitat should receive a roughly 50:50 ratio of direct sunlight to shade (http://www.wildtrout.org/sites/default/files/news/Keeping%20Rivers%20Cool_Guidance%20Manual_v1%20%2023%2008%2012.pdf)
This ratio allows enough sunlight to reach the stream bed and banks to promote healthy vegetation growth whilst also preventing plants from encroaching into the channel. It also helps to keep the water cool during hot summer months. The combination of low flows and direct sunlight has directly influenced the rate of vegetation growth that is choking the channel.

At the downstream extent of the straightened reach, flow is slightly impounded by a sill between the footings of a footbridge. The sill is a brick structure in a

state of deterioration. Head loss over the sill is minimal but the low-flow conditions through the channel make even the smallest of obstacles potential barriers for small and juvenile fish.

Figure 9: The crumbling brick sill under the footbridge from Wey Mill onto the meadow

Overall the original channel is a relatively poor habitat for flow-loving fish. However, the stream has great potential to perform as a both a high quality habitat and a bypass route around the mill weir on the milling channel.

There is huge potential for enhancing the quality of available habitat by reconnecting the original channel with the majority of the available flow. Additional benefits also include the provision of sustainable channels requiring very little maintenance as well as potentially bringing flood risk benefits. There may be additional opportunities for re-wetting adjacent meadows, if required, to boost riparian biodiversity and create a river environment that complements the Bishop Meadow reserve. Increasing flow through the natural stream would require the modification (or removal) of the outfall weir. This would not only improve the stream habitat but would also reconnect the North Wey upstream of Bishops Meadow with the river downstream.

In-stream vegetation would initially require management to allow for greater flow conveyance but if higher flows were to be permanently established and some intermittent shade was to be introduced, it is unlikely that such unchecked growth would re-occur.

3.3 The main river

Downstream of the confluence of the two streams, the river is impounded by an Environment Agency flow gauging station. This is in the form of a crump weir with a high crest. The structure is a complete block for fish passage and is impounding flows and trapping bed material upstream. This structure is adversely affecting the overall habitat performance of the river through Bishops Meadows by slowing flows upstream and as well as acting as a barrier to fish migration.

Removing the weir would markedly improve the habitat value of the reach. This would however be an expensive undertaking and a replacement system for monitoring river flows would have to be installed.

Figure 10: The gauging weir is a block for upstream fish migration and impounds the water upstream causing slow, deep flows and heavy sediment

A less effective alternative to complete removal could be to install an 'easement' structure onto the weir that would allow fish passage over the obstacle. This kind

of modification could mitigate the effects of habitat fragmentation along the reach but will not resolve issues associated with the impoundment of water upstream (such as sedimentation and poor water quality).

An easement consisting for example, of timber baulks mounted onto the downstream face of the weir that baffle the flow and increase water depth, is a relatively small-scale operation that (in most cases) does not require heavy plant machinery to accomplish. The structure is owned and operated by the EA and they have undertaken trials on the use of low-cost baffles on similar structures to improve fish passage. This issue should be raised with the River Wey Fisheries Action Plan group and the EA, as solving fish migration issues at sites like this is seen as a priority action under the Water Framework Directive. A caveat to this action is the requirement to also solve fish migration issues at Weydon Mill to open up access for fish migration all the way upstream to the high quality habitat that exists above Wrecclesham.

Downstream of the gauging weir flows are unimpeded and the gravel bed is clearly visible. Swathes of water crowfoot and starwort are established in the faster flowing water over shallow riffles. Intermittent tree cover is providing a good ratio of direct sunlight to shade and marginal vegetation is diverse.

Figure 11: Good quality habitat with a clear gravel bed, swathes of water crowfoot, and a variety of emergent and marginal plants

In places, beds of reed sweetgrass are naturally 'pinching' the stream. Emergent plants can only encroach into the channel to the point where the water velocity is too fast for them to establish. This means that beds of emergent vegetation can help to maintain flow speeds by colonising slacker water and naturally narrowing the stream.

Figure 12: Emergent reeds pinching the channel, maintaining faster flow velocity and helping scour silt from the gravel bed.

Water depth varies along the reach but the distinction between pools and riffles is not particularly pronounced. A greater definition between the deeper pools and shallower riffles would increase the habitat diversity and value of the reach – possibly increasing available spawning habitat and holding water for adult fish.

The reach would benefit from more woody debris habitat to provide extra shelter for juvenile fish, cover for adults, and habitat for invertebrates. Woody debris can also help to deflect flows, scour the river bed and introduce further habitat diversity (such as pools and riffles) into the stream.

Throughout the reach the river is relatively accessible and visible from the adjacent field. The rough un-mown margin on the upper bank is an important component of the river habitat and should be maintained as such. This rough margin is important for both terrestrial invertebrates and aquatic insects that have a terrestrial life-stage. It is also an important habitat for birds and small mammals.

Towards the downstream boundary of Bishops Meadow, tell-tale tracks of bank erosion confirm that the river is being accessed by dogs. Dogs scrambling up and down river banks can lead to serious erosion problems if unchecked. Often the solution is to establish specific dog access points that can be reinforced with gravel etc. At present the problem is not a serious one but should be carefully monitored.

Figure 13: Erosion tracks from dogs scrambling in and out of the river. Unchecked this can become a serious problem.

4. Conclusions

Overall the North Wey through Bishops Meadow is a river with a great deal of potential. Substantial impoundments and barriers to fish passage hinder habitat development and significant changes to these structures are required in order for the river's full potential to be realised.

The original natural channel in particular has the potential to be an important and diverse wild habitat that could be a ready-made bypass around the Weydon Mill weir. In order for this to be brought to fruition, the ratio of water flowing through the stream compared to the milling channel would have to be dramatically altered in favour of the original stream. A reduction in flow to the milling channel will require a corresponding modification to the existing channel form to ensure that the reduced flow regime does not result in heavy siltation.

A tree planting scheme would be of great benefit to the original channel but only if appropriate flows could be restored.

Further habitat enhancements such as the introduction of more woody debris would also be of great value to fish of all life stages.

5. Recommendations

In order for the North Wey at Bishops Meadow to perform to its full potential as a wild river ecosystem, a number of actions are recommended. There are some actions that can be undertaken by volunteers to improve local habitat in the short-term and some actions that will require a larger capital works to improve the overall functionality of the river as part of a wider river system.

5.1 Short-term Actions

The overgrown emergent vegetation in the orignal channel needs to be managed in order for the stream to function properly. The channel needs to be opened-up to allow water to flow unempeded. This can be achieved either by hand using a turk scythe etc or with a glyphosate-based contact herbacide.

NB: The use of herbacides near water requires Environment Agency permission and the correct NTCP qualification.

This would be best done sympathetically – opening up a flow path through the vegetation as opposed to completely clearing the channel.

Management of in-stream vegetation should also include approapriate riparian tree management. Overgrown emergent and marginal vegetation is often a

symptom of low flows combined with an overabundance of direct sunlight. It is strongly recommended that additional native trees are planted along the reach to help regulate both the overgowing vegetation and the temperature of the river during summer months.

The overgrown channel is primarily symptomatic of low-flow conditions. A permenant solution must involve increasing the volume of flows through the reach.

The habitat from the gauging weir towards the downstream boundary of Bishops Meadow would benefit from some simple habitat improvement works. The installation of a few large woody debris (LWD) deflectors fixed to the bed in key locations could help to deepen existing pools and gently 'sort' gravels – keeping them clean of sediment and enhancing spawning habitat.

Deeper, more pronounced pools would provide good holding habitat for adult fish whilst shallow, fast flowing gravel riffles would provide new spawning opportunities for trout and other gravel spawning species such as dace. Fast flowing riffles are also vital habitat for aquatic flora such as water crowfoot and are, important for a wide range of freshwater invertebrates.

Figure 14: An example of a very simple LWD deflector fixed to the bed with posts and wire

Figure 15: A small LWD log deflector fixed over a shallow riffle to promote localised scour and sort gravels for spawning habitat

Figure 16: LWD in an upstream 'V' formation. Flows are focussed into the centre of the channel – scouring a pool and lifting gravels from the bed.

LWD and coarse woody debris (CWD) such as brushwood are important components of the river ecosystem. CWD provides juvenile nursery habitat, cover for adult fish and important habitat for fly life. It is also one of the simplest habitat features to re-introduce into a stream.

CWD mattresses can be created from branches or bushwood bundles packed tightly together at or just below the surface and fixed in place with sweet-chestnut posts and fencing wire. These act as sediment traps that develop into good habitat for marginal plants and facilitate natural channel narrowing.

Brushy banches can also be fixed into the river in key locations to increase flow variation and provide sheltered lies where fish can conserve energy and keep an eye out for food drifting in the main current.

Figure 17: A live willow CWD (brushwood) marginal mattress installed as a habitat feature. This will narrow the channel whilst also trapping sediment and developing into a dense stand of marginal plants and willow scrub.

Almost all LWD and CWD in streams is derived from trees located within the riparian corridor. Streams with adequate woody debris tend to have greater habitat diversity, a natural meandering shape and greater resistance to high water events.

Traditionally, many land managers, riparian owners and river authorities have treated woody debris in streams as a nuisance and have removed it, often with uncertain consequences. This is often unnecessary and harmful to stream habitat. Removal of woody debris reduces the amount of organic material supporting the aquatic food web, removes vital in-stream habitats that fish will utilise for shelter and spawning and reduces the level of erosion resistance provided against high flows. In addition, LWD improves the stream structure by enhancing the substrate (scouring and sorting gravel) and diverts the stream current in such a way that pools and riffles are likely to develop.

More information on LWD and CWD structures can be found in The Wild Trout Survival Guide available to buy from the Wild Trout Trust (WTT) website at http://www.wildtrout.org/content/wtt-publications
Alternatively, a PDF version of The Chalkstream Habitat Manual can be viewed at the same web address.

The healthy and diverse river habitat through the lower reaches of Bishops Meadow is an important resource for local wildlife and should be preserved as such. The river may benefit from the involvement of local people taking an interest and appreciating the habitat as a valuable local amenity. Engaging local people through volunteer work, informational/educational signs etc. is often effective and valuable. The installation of LWD/CWD habitat enhancements could be undertaken with local volunteers, helping to connect local people to the river and its wildlife. The WTT operates a Practical Visit (PV) scheme that helps to deliver volunteer focussed habitat enhancment projects.

5.2 Long-term Actions

The offtake weir currently depriving the natural channel of flow should be re-engineered so that the majority of water flows down via this route. Increasing flow rate through the river's natural channel would open up a long stretch of good quality habitat for flow-loving plants and animals whilst also functioning as a bypass around the Wey Mill weir obstruction.

Simultaneous channel narrowing works on the milling channel should be undertaken to complement the reduction in available flow. Oppertunities to create a two stage channel within the exisiting milling channel may have significant flood defence benefit.

It is recommended that the Environment Agency be contacted to discuss the feasability of such a project. Bypassing the obstructions could contribute towards meeting Water Framework Directive targets for this stretch of the North Wey and may attract funding.
It is recommended that a detailed study be commissioned by the EA to determine an appropriate devision of flows between the two streams. It is also reccommended that a specialist river restoration company be contracted to undertake these

As the majority of available water currently flows adjacent to a number of private properties; sensitive liaison with riparian land owners, EA fisheries and flood defence officers would be absolutely vital in securing the future of such a scheme.
works (perhaps allowing for a volunteer team to carry out less technical habitat enhancement works on the main channel downstream of the gauging weir).

The gauging weir is potentially a complete barrier to upstream migration. It is recommended that a dialogue is opened with the Environment Agency with regards to easing fish passage over the structure. Ideally, the structure could be completely removed in favour of a more modern gauging station that does not require a crump weir. Alternatively, a project could be designed to ease fish passage without removing the weir or affecting the performance of the gauging station. An example easement project using timber baulks to baffle flow and raise water levels over the downstream face of a crump weir is shown in **Figure 18** below:

Figure 18: An example timber baulk easement fixed to a crump weir

6. Making it happen

There is the possibility that the WTT could help to start an enhancement project downstream of the gauging weir. Physical enhancement works could be kick-started with the assistance of a WTT 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.

Acknowledgement

The WTT would like to thank the Environment Agency for supporting the advisory and practical visit programmes.

Disclaimer